PRELIMINARY GEOTECHNICAL INVESTIGATION

QUARRY CREEK II
CARLSBAD/OCEANSIDE, CALIFORNIA

GEOCON
INCORPORATED

GEOTECHNICAL
ENVIRONMENTAL
MATERIALS

PREPARED FOR

THE CORKY MCMILLIN COMPANIES
SAN DIEGO, CALIFORNIA

MAY 11, 2012
PROJECT NO. 07135-42-03

GEOCON
INCORPORATED
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS

Project No. 07135-42-03
May 11, 2012

The Corky McMillin Companies
Post Office Box 85104
San Diego, California 92186

Attention: Mr. Don Mitchell

Subject: PRELIMINARY GEOTECHNICAL INVESTIGATION
QUARRY CREEK II
CARLSBAD/OACEANSIDE, CALIFORNIA

Dear Mr. Mitchell:

In accordance with your authorization of our proposal LG-11294, dated October 11, 2011, we are pleased to submit the results of our geotechnical investigation for the proposed Quarry Creek II project. The accompanying report presents the results of our recent subsurface investigation. Conclusions and recommendations of this study are based on review of available published geotechnical reports and literature, observations during grading currently being performed on the property for reclamation, previous subsurface geotechnical exploration and site reconnaissance of existing conditions.

The eastern half of the property has been used for mining and crushing rock to produce commercial aggregates. As the result, the eastern half of the site is underlain by compacted fill, previously placed fill, undocumented fill, sedimentary, volcanic, and intrusive bedrock. Currently, reclamation grading is occurring on this portion of the site. The western half of the site is in an ungraded natural condition. The accompanying report presents findings from our studies relative to geotechnical engineering aspects of developing the site. The site is considered suitable for the proposed improvements provided the recommendations of this report are followed.

Should you have questions regarding this report, or if we may be of further service, please contact the undersigned at your convenience.

Very truly yours,

GEOCON INCORPORATED

Ali Sadr
CEG 1778

Rodney C. Mikesell
GE 2533

AS:RCM:dmc

(6/del) Addressee

6960 Flanders Drive ■ San Diego, California 92121-2974 ■ Telephone 858.558.6900 ■ Fax 858.558.6159

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PRELIMINARY GEOTECHNICAL INVESTIGATION

1. PURPOSE AND SCOPE

This report presents the results of a preliminary geotechnical investigation for the proposed Quarry Creek II development. The purpose of the geotechnical investigation is to evaluate surface and subsurface soil conditions and general site geology, and to identify geotechnical constraints that may impact development of the property. In addition, the purpose of this report is to provide preliminary foundation design criteria, concrete flatwork recommendations, retaining wall recommendations, excavation and remedial grading considerations that can be utilized in developing project budgets. The scope of this investigation also included a review of readily available published and unpublished geologic literature, aerial photographs and the following documents previously prepared for the property:

1. *Update Geotechnical Investigation, Amended Reclamation Plan, Quarry Creek Refined Alternative 3, Carlsbad, California,* prepared by Geocon Incorporated, dated September 10, 2009 (Project No. 07135-42-01).

2. *Limited Geotechnical Investigation to Evaluate Hardrock Constraints for Quarry Creek, Carlsbad, California,* prepared by Geocon Incorporated, dated April 9, 2004 (Project No. 07135-42-01B.

3. *EIR – Level Soil and Geologic Reconnaissance Quarry Creek II Carlsbad/Oceanside, California,* prepared by Geocon Incorporated, dated October 20, 2011(Project No. 07135-42-01B).

The site is located south of State Route 78 and west of College Boulevard in the city of Carlsbad, California (see Vicinity Map, Figure 1).

The eastern portion of the site is currently being graded as part of the reclamation process. Geocon Incorporated is performing compaction testing and observation services during the grading operations. As graded conditions as of the date of this report are shown on the Geologic Map (Figures 2 and 3). Import fill operations are ongoing to complete reclamation grading. We will update the geologic map once reclamation grading is complete.

We performed a limited field investigation in April 2004 for the western portion of the site that included excavating six small-diameter exploratory borings to a maximum depth of approximately 61 feet. The results were published in Reference No. 2. Our current study included excavating 5 large diameter borings and 22 trenches. The boring and trench logs and other details of the field investigation are presented in Appendix A.

We tested selected soil samples obtained during the field investigation to evaluate pertinent physical properties for engineering analyses and to assist in providing recommendations for site grading. Details of the laboratory tests and a summary of the test results are presented in Appendix B and on the boring logs in Appendix A. The Geologic Map, Figures 2 and 3 also present the locations of the exploratory excavations

Other reports reviewed as part of this study are summarized on the *List of References* at the end of this report.

2. SITE AND PROJECT DESCRIPTION

The Quarry Creek II area encompasses approximately 45 developable acres of property that has undergone many years of mining rock with associated crushing and screening to produce commercial aggregate products. The majority of previous mining activity occurred in the eastern and southern portions of the site. Waste products from mining were subsequently placed in canyon or pit areas to reclaim quarry excavations. This has resulted in placement of mostly undocumented fill in depressions, as well as some compacted fill. A former concrete batch plant and base-coarse crushing and screening plant operated by Hanson Aggregates recently occupied the central portion of the property. Other portions of the property were previously used for storage purposes, which include stockpiles of concrete and asphalt rubble, bioremediation stockpiles, and other materials.

Reclamation grading of the previously mined area commenced in July 2011 and is expected to continue into February 2012. During reclamation grading, undocumented fills are being removed and replaced as compacted fill. Alluvial soils within the drainage area is being removed to within 3 feet of the current groundwater elevation and recompacted. Drop structures, levees, and rock revetment slopes are being constructed along and in Buena Vista Creek drainage. Currently, reclamation grading has resulted in removal of undocumented fill and replacement with compacted fill on the north side of Buena Vista Creek and majority of the areas south of the creek. Reclamation grading will result in large sheet graded pads on the eastern half of the property on both the north and south sides of Buena Vista Creek.

Topographically, the property slopes northward, southward, and westward, following the east-west natural drainage of Buena Vista Creek valley and its tributaries. The original valley-slope topography has been lowered by quarry operations to create moderately sloping surfaces in most of the planned reclamation area. However, mining of rock in the northeast quadrant has created near-vertical rock slopes. The cut has exposed fractured rock, which is very strong and considered stable in its temporary steep condition. Recommendations for a permanent slope condition are provided in the slope stability section of this report.

Slopes on the south side of the valley have been graded to permanent 2:1 (horizontal:vertical) cut slopes with benches, bench-drains and brow-ditches. On the north side of the site, reclamation grading has resulted in 2:1 cut slopes. Elevations in the eastern half of the property vary from approximately 80 feet Mean Sea Level (MSL) to above 300 feet MSL in open-space areas. At the completion of reclamation grading, sheet graded pad elevations will vary from approximately 100 to 120 feet MSL. On the western ungraded portion of the site, existing site elevations vary from approximately 80 feet MSL to 160 feet MSL.

Review of the preliminary grading plan for Quarry Creek II indicates regrading in the eastern half of the property after reclamation grading will generally consist of cuts and fills up to 40 feet and 10 feet, respectively. Within the ungraded western portion, cuts and fills up to 35 and 30 feet, respectively will occur to create large sheet-graded pads. Development will also include the construction of a bridge across the creek, roadways, and utilities. A report specific to the bridge will be provided separately.

The site description and proposed development are based on a site reconnaissance and review of the reclamation plans and preliminary grading plans. If development plans differ significantly from those described herein, Geocon Incorporated should be contacted for review and possible revisions to this report.

3. SOIL AND GEOLOGIC CONDITIONS

Eight surficial soil deposits and four geologic formations were encountered and/or mapped on the property. Surficial soil deposits include undocumented fill, compacted fill, previously placed fill, topsoil (unmapped), surficial landslide debris, alluvium, and colluvium. Formational units include Quaternary-age Terrace Deposits, Tertiary-age Volcanic Rock, Santiago Formation, and Jurassic-age Salto Intrusive rock. Mapped limits of the geologic units are shown on the Geologic Maps (Figures 2 and 3). Geologic Cross Sections are presented on Figures 4 and 5. The surficial soil types and geologic units are described below.

3.1 Compacted Fill (Qcf)

Compacted fill placed during reclamation grading exists across the northeast portion of the property. Observation and compaction testing of the fill has been performed by Geocon Incorporated. A report documenting compaction tests will be provided at the completion of reclamation grading. The fill is predominately comprised of silty to clayey sand with varying amounts of rock fragments, soil rock fills, and windrows of oversize rock and concrete. A 10-foot hold-down for oversize rock has been recommended during reclamation grading. Compacted fill is considered suitable for support of additional fill and structural loads.

3.2 Undocumented Fill (Qudf)

Undocumented fill exists in the northeast portion of the property beyond the reclamation grading limit and within the existing access road from Haymar Drive. The majority of this undocumented fill will likely be removed based on proposed cuts for Quarry Creek II. However, we expect some remedial grading will be needed below proposed cut elevations to completely remove undocumented fill. A small amount of undocumented fill also exists just west of the graded reclamation parcels near the central portion of the overall Quarry Creek II project. Undocumented fill is unsuitable in its present condition, and will require removal and recompaction to support additional fill or structural improvements. Oversize materials encountered during remedial grading may require breaking down and special placement procedures in deeper fill areas.

In the northeast portion of the property, a limited amount of undocumented fill was left in-place during reclamation grading due to the presence of groundwater. Based on our observations during reclamation grading and potholes performed, we expect less than 3 to 5 feet of fill was left below groundwater in some areas. We do not expect the presence of the undocumented fill will impact future development.

3.3 Previously Placed Compacted Fill (Qpcf)

Limited areas in the northeast and southeast portions of the property are underlain by previously placed compacted fill (see Geologic Map). According to a report by Ninyo and Moore (dated August 31, 2000), most of the approximately 10 feet of documented fill in the bottom of the northern pit area had been placed between approximately 1988 and 2000. The report describes the fill as … *interlayered, medium dense to dense, clayey and silty sand, clayey gravel and stiff sandy clay*. Portions of the compacted fill were buried beneath stockpiles of oversize shot-rock that was removed during recent reclamation grading. The upper approximately 3 to 5 feet of previously placed compacted fill was removed during reclamation grading and recompacted.

Previously placed compacted fill associated with the development of the eastern quarry (Wal-Mart shopping center) encroaches into the southeastern portion of the property. These materials were partially removed and recompacted during the recent grading operations. Based on observations during reclamation grading, the fill appears to be relatively dense with adequate moisture content and considered suitable for support of structural improvements.

3.4 Previously Placed Fill (Qpf)

Previously placed fill exists near Haymar Drive and Highway 78 along the northern property boundary. The approximate limit of the previously placed fill is shown on Figure 2 (Geologic Map). These soils should not impact future development of the property.

3.5 Topsoil (Unmapped)

Portions of the western side of the site are irregularly blanketed by 1 to 3 feet of topsoil consisting of loose, porous, dark brown, silty to clayey, fine sand. Topsoil is compressible and expansive, and will require removal and recompaction within areas of planned development. Expansive clays should be placed in deeper excavations during grading.

3.6 Surficial Landslide Debris (Qlsf)

Several suspicious surficial landslides are mapped within the western portion of the site, along the south banks of the Buena Vista Creek basin. Due to the limited access to these areas, subsurface investigation was not practical at this time. Their existence will be verified when access is available or during the grading operations. Trench T-5 was excavated at one of these areas and showed approximately 5 feet of sandy clay material overlying bedrock formation. The surficial landslide debris, if they exist, are considered unsuitable for receiving fill or structures and require removal.

3.7 Alluvium (Qal)

Alluvial deposits are present within the major east-west drainage of Buena Vista Creek, as well as in the northeastern and southwestern tributary canyons that converge with Buena Vista Creek in the central portion of the site. The alluvial soils generally consist of loose, porous dark gray to dark brown, very clayey, fine to medium sand, and clayey sand and silt with occasional layers of slightly silty sand. Areas of deepest alluvium are located in the central portion of the site adjacent to the original channel of Buena Vista Creek and its tributaries. The alluvium is compressible and not suitable for support of additional fill and/or structural loads and will require partial (dependent upon groundwater depths) to complete removal. Remedial grading of the alluvium along the north and south sides of the main Buena Vista Creek drainage has occurred during the reclamation grading currently in progress. Alluvium is expected to be encountered along the toe of the south facing fill slope at the west end of the property.

3.8 Colluvium (Qc)

Colluvial deposits were encountered in the southwest portion of the site mostly along the sides of the draining tributary canyons. Colluvium is comprised of approximately 4 to 6 feet of loose dark brown,

very clayey to silty, fine sand. Due to the loose unconsolidated condition of the colluvium, removal and recompaction will be required to provide suitable support for placement of compacted fill or structural improvements.

3.9 Terrace Deposits (Qt)

Extensive and thick river terrace deposits consisting of medium-dense to dense, light reddish-brown to olive-brown, gravelly, silty to clayey, medium to coarse sand to cohesionless sand with occasional layers of silty clay are present in the western and southwest portions of the site. Except near depositional contacts (or unconformities) with older formations, this unit is typically massive to horizontally bedded, relatively dense and exhibits low compressibility characteristics. Terrace Deposits are most prevalent in the southwestern portions of the site. The sandy zones are suitable for support of fill and/ or structural loads in their present condition. The clayey zones, however, possess low shear strength and high expansion potential.

Our large diameter boring LB-2 performed in the proposed cut slope located at the southwest boundary, adjacent to Simsbury Court, encountered materials consists of interbedded silty sand, cohessionless sand and clay layers which are occasionally partially remolded. We recommend a stability buttress be constructed along this cut slope to provide adequate slope stability.

3.10 Tertiary Volcanics (Tv)

Tertiary-age volcanic rocks are present in a limited lens-shape area exposed in the southeast portion of the site in the existing 2:1 cut slope between approximate elevations 120 to 140 feet MSL. It consists of deeply weathered, massive light reddish-brown, moderately strong, volcanic tuff. This unit exhibits medium-dense to dense characteristics with little indication of slope erosion. This unit is considered to possess suitable geotechnical characteristics for slope stability and for support of fill and/or structural loads.

3.11 Santiago Formation (Ts)

The Eocene-aged Santiago Formation, consisting of dense, massive bedded light brown to greenish-gray sandstones and thin interbedded siltstones is present in the north-central and south-central portions of the site. The Santiago Formation is generally granular and possesses suitable geotechnical characteristics in either an undisturbed and/or properly compacted condition. However, the occurrence of clayey siltstones and claystone layers in this unit may generate moderate to highly expansive materials, or localized expansive zones at grade. Where practical, clayey zones of the Santiago Formation should be placed at least 3 feet below proposed subgrade elevations.

3.12 Salto Intrusive (Jspi)

The Jurassic-aged Salto Intrusive consists of a steeply jointed, dark gray, very strong tonalite to gabbro rock considered to be older than the Peninsular Range Batholith and more closely related to the formation of the Santiago Peak Volcanics (Larsen, 1948). This granitoid bedrock unit is present in the northeast and southeast corners of the property and is the predominant geologic unit that has been mined for aggregate on the property. Typically, this bedrock unit outcrops along the eastern or southeastern boundary of the site, or is covered by fill in the central portions of the site. Exploratory excavations encountered mostly buried intrusive rock that exhibited a variable weathering pattern ranging from intensely weathered and fractured material near contacts with the overlying sedimentary rocks, to fresh, extremely strong crystalline rock within quarried areas.

4. GROUNDWATER

Groundwater was encountered in the major lower elevation drainage areas of Buena Vista Creek and its tributaries at elevations between 70 to 80 feet MSL. Depth of groundwater is subject to fluctuation from natural seasonal variations. The relationship between alluvial removals and the position of groundwater table and time of year remedial grading is performed are discussed in the *Conclusions and Recommendations* section of this report.

5. GEOLOGIC HAZARDS

5.1 Faulting and Seismicity

Review of geologic literature, previous geotechnical reports for the property, and observations during our current field investigation indicates no active faults traverse the property. One fault was observed in Salto Intrusive rock across the quarry slope in the northeast corner of the property. However, an exploratory trench excavated through the Tertiary Santiago Formation across the fault confirmed the fault did not displace the Eocene-age sedimentary unit. As such, the fault is considered inactive and not a constraint to the property.

According to the results of the computer program *EZ-FRISK* (Version 7.62), 8 known active faults are located within a search radius of 50 miles from the property. The nearest known active fault is the Newport-Inglewood- Rose Canyon Fault Zone, located approximately 6 miles east of the site and is the dominant source of potential ground motion. Earthquakes that might occur on the Newport-Inglewood-Rose Canyon Fault Zone or other faults within the southern California and northern Baja California area are potential generators of significant ground motion at the site. The estimated deterministic maximum earthquake magnitude and peak ground acceleration for the Newport Inglewood –Rose Canyon Fault are 7.5 and 0.34 g, respectively.

We used *Boore-Atkinson* (2008) NGA USGS2008, *Campbell-Bozorgnia* (2008) NGA USGS 2008, and Chiou-Youngs (2008) NGA acceleration-attenuation relationships in the calculation of the peak ground accelerations (PGA). Table 5.1.1 lists the estimated maximum earthquake magnitudes and PGA's for the most dominant faults for the site location calculated for Site Class D as defined by Table 1613A.5.3 of the 2010 CBC.

TABLE 5.1.1
DETERMINISTIC SPECTRA SITE PARAMETERS

Fault Name	Distance from Site (miles)	Maximum Earthquake Magnitude (Mw)	Peak Ground Acceleration		
			Boore-Atkinson 2008 (g)	Campbell-Bozorgnia 2008 (g)	Chiou-Youngs 2008 (g)
Newport-Inglewood- Rose Canyon	6	7.50	0.30	0.26	0.34
Elsinore	21	7.85	0.21	0.15	0.19
Coronado Bank	23	7.40	0.18	0.12	0.14
Palos Verdes Connected	23	7.70	0.19	0.13	0.16
San Joaquin Hills Thrust	35	7.10	0.18	0.10	0.09
Earthquake Valley	42	6.80	0.13	0.09	0.11
San Jacinto	45	7.88	0.13	0.08	0.10
Chino	47	6.80	0.08	0.05	0.05

We used the computer program *EZ-FRISK* to perform a probabilistic seismic hazard analysis. The computer program *EZ-FRISK* operates under the assumption that the occurrence rate of earthquakes on each mapped Quaternary fault is proportional to the fault slip rate. The program accounts for earthquake magnitude as a function of fault rupture length. Site acceleration estimates are made using the earthquake magnitude and distance from the site to the rupture zone. The program also accounts for uncertainty in each of following: (1) earthquake magnitude, (2) rupture length for a given magnitude, (3) location of the rupture zone, (4) maximum possible magnitude of a given earthquake, and (5) acceleration at the site from a given earthquake along each fault. By calculating the expected accelerations from considered earthquake sources, the program calculates the total average annual expected number of occurrences of site acceleration greater than a specified value. We utilized acceleration-attenuation relationships suggested by Boore-Atkinson (2008) NGA USGS2008, Campbell-Bozorgnia (2008) NGA USGS 2008, and Chiou-Youngs (2008) in the analysis. Table 5.1.2 presents the site-specific probabilistic seismic hazard parameters including acceleration-attenuation relationships and the probability of exceedence for Site Class D.

TABLE 5.1.2
PROBABILISTIC SEISMIC HAZARD PARAMETERS

Probability of Exceedence	Peak Ground Acceleration		
	Boore-Atkinson, 2008 (g)	Campbell-Bozorgnia, 2008 (g)	Chiou-Youngs, 2008 (g)
2% in a 50 Year Period	0.52	0.42	0.47
5% in a 50 Year Period	0.39	0.32	0.35
10% in a 50 Year Period	0.31	0.25	0.27

The California Geologic Survey (CGS) provides a computer program that calculates the ground motion for a 10 percent of probability of exceedence in 50 years based on the average value of several attenuation relationships. Table 5.1.3 presents the calculated results from the Probabilistic Seismic Hazards Mapping Ground Motion Page from the CGS website.

TABLE 5.1.3
PROBABILISTIC SITE PARAMETERS FOR SELECTED FAULTS
CALIFORNIA GEOLOGIC SURVEY

Calculated Acceleration (g) Firm Rock	Calculated Acceleration (g) Soft Rock	Calculated Acceleration (g) Alluvium
0.27	0.29	0.33

While listing peak accelerations is useful for comparison of potential effects of fault activity in a region, other considerations are important in seismic design, including the frequency and duration of motion and the soil conditions underlying the site. Seismic design of the structures should be evaluated in accordance with the California Building Code (CBC) guidelines.

5.2 Liquefaction

Liquefaction analyses were performed during Geocon's 2009 report for reclamation grading. Results of the analyses indicate alluvial deposits below the groundwater should not liquefy for the design level acceleration. As the analysis shows liquefaction should not occur, potential impacts associated with liquefaction such as surface manifestation (sand boils) and lateral spreading are not considered to be adverse with respect to the proposed development.

5.3 Landslides

Review of 1995 published landslide maps of the California Geological Survey (formerly the Division of Mines and Geology) and a previous geotechnical report by Ninyo and Moore (August 23, 2000),

suggested the presence of suspected landslide deposits in the southwest quadrant of the site. However, observations of intact outcrops and current subsurface investigation confirmed that the landslide does not exist. Several suspicious surficial landslides are mapped along the south bank of the creek. These areas were not accessible for subsurface investigation. These potential landslides, even if confirmed, should not have significant impact on the proposed development.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 General

6.1.1 From a geotechnical engineering standpoint, it is our opinion that the site is suitable for the proposed development, provided the recommendations presented herein are implemented in design and construction of the project.

6.1.2 Soil conditions identified during this study that may impact development include compressible surficial soils (undocumented fill, alluvium, colluvium, surficial landslide debris and topsoil) that will require remedial grading. Undocumented fill may contain large rock fragments that require special placement procedures. Undocumented fill will remain beyond the limits of reclamation grading that will require removal and recompaction for support of structural improvements.

6.1.3 The property is approximately 7 miles from the Newport Inglewood/Rose Canyon Fault. It is our opinion active and potentially active faults do not extend across or trend toward the site. Risks associated with seismic activity consist of the potential for strong seismic shaking. Building setbacks will not be required for the planned development due to faulting.

6.1.4 Several potential surficial landslides are mapped along the north-facing slope within the western portion of the site. Due to the limited access, these areas could not be reached for subsurface investigation. If encountered during the grading operations, total removal of the slide debris within the grading area is recommended.

6.1.5 Subsurface conditions observed may be extrapolated to reflect general soil/geologic conditions; however, some variations in subsurface conditions between trench and boring locations should be anticipated.

6.2 Excavation and Soil Characteristics

6.2.1 Excavation of the Terrace Deposits, Santiago Formation and weathered portion of the Tertiary Volcanics and Salto Intrusive are expected to require a heavy to very heavy effort to excavate. Less weathered and fresh Salto Intrusive bedrock may require blasting or specialized rock breaking techniques to efficiently excavate and handle. Very heavy effort with possible refusal is expected for excavations into the volcanic and intrusive rocks. Oversize material may be generated which would require special handling or exportation from the site.

6.2.2 The soil encountered in the field investigation is considered to be "expansive" (expansion index greater than 20) as defined by 2010 California Building Code (CBC) Section 1802.3.2. Table 6.2 presents soil classifications based on the expansion index. Based on the results of our laboratory testing, presented in Appendix B, we expect the on-site materials will possess a "very low" to "very high" expansion potential (Expansion Index of 20 and greater).

TABLE 6.2
EXPANSION CLASSIFICATION BASED ON EXPANSION INDEX

Expansion Index (EI)	Expansion Classification
0 – 20	Very Low
21 – 50	Low
51 – 90	Medium
91 – 130	High
Greater Than 130	Very High

6.2.3 We performed laboratory tests on samples of the site materials to evaluate the percentage of water-soluble sulfate content. Results from the laboratory water-soluble sulfate content tests are presented in Appendix B and indicate that the on-site materials at the locations tested possess "negligible" sulfate exposure to concrete structures as defined by 2010 CBC Section 1904.3 and ACI 318. The presence of water-soluble sulfates is not a visually discernible characteristic; therefore, other soil samples from the site could yield different concentrations. Additionally, over time landscaping activities (i.e., addition of fertilizers and other soil nutrients) may affect the concentration.

6.2.4 Geocon Incorporated does not practice in the field of corrosion engineering. Therefore, further evaluation by a corrosion engineer may be performed if improvements that could be susceptible to corrosion are planned.

6.3 Subdrains

6.3.1 Canyon subdrains are recommended to mitigate the potential for adverse impacts associated with observed and potential seepage conditions and to collect perched water that migrates along the contact between natural ground and fill surfaces. Figure 6 presents a typical canyon subdrain detail. Recommended subdrain locations are depicted on the Geologic Map, Figures 2 and 3.

6.3.2 The final 20-foot segment of a subdrain should consist of non-perforated drainpipe. At the non-perforated/perforated interface, a seepage cutoff wall should be constructed on the downslope side of the junction in accordance with Figure 7. Subdrains that discharge into a natural drainage course or open space area should be provided with a permanent headwall structure in accordance with Figure 8.

6.3.3 Final grading plans should show the location of the proposed subdrains. Upon completion of remedial excavations and subdrain installation, the project civil engineer should survey the drain locations and prepare an "as-built" map depicting the existing conditions. The final outlet and connection locations should be determined during grading. The grading contractor may consider videoing the subdrains shortly after burial to check proper installation and to check that the pipe has not been crushed. As a minimum, we recommend the subdrain for the buttress fill be videoed. The contractor is responsible for the performance of the drains.

6.4 Grading

6.4.1 All grading should be performed in accordance with the *Recommended Grading Specifications* contained in Appendix D. **Where the recommendations of Appendix D conflict with this section of the report, the recommendations of this section take precedence**.

6.4.2 Prior to commencing grading, a preconstruction conference should be held at the site with the owner or developer, grading contractor, civil engineer, and geotechnical engineer in attendance. Special soil handling and/or the grading plans can be discussed at that time.

6.4.3 Grading should be performed in conjunction with the observation and compaction testing services of Geocon Incorporated. Fill soil should be observed on a full-time basis during placement and tested to assess in-place dry density and moisture content.

6.4.4 Site preparation should begin with removal of all deleterious material and vegetation. The depth of removal should be such that material exposed in cut areas or soil to be used for fill is relatively free of organic matter. Deleterious material generated during stripping and/or site demolition should be exported from the site.

6.4.5 Undocumented fill, topsoil, colluvium, alluvium and landslide debris within areas of planned grading should be removed to firm natural ground and properly compacted prior to placing additional fill and/or structural loads. The actual extent of unsuitable soil removals should be determined in the field by the soil engineer and/or engineering geologist. Overly

wet surficial materials, where encountered, will require drying and/or mixing with drier soils to facilitate proper compaction.

6.4.6 Alluvium should be removed down to competent formational bedrock or to within approximately 3 feet of the groundwater table, whichever occurs first. During excavation of the alluvium, test pits should be periodically excavated to determine groundwater depths. Special equipment such as swamp cats, excavators, and top loading operations may be required to excavate the alluvium. Removals at the toe of slopes along the channel should extend out at a 1:1 plane from the toe to the bottom of the removal. A typical lateral extent of removal is shown on Figure 9.

6.4.7 Graded areas may expose volcanic/intrusive rock at finish grade. The presence of hard rock may impact future development. We recommend hard rock be undercut to a depth of at least 5 feet below finish grade in building pads and 2 feet below utilities and a soil cap replaced.

6.4.8 After removal of unsuitable material as recommended above, the base of overexcavations and natural ground surfaces (including previous compacted fill soil) to receive additional fill should be scarified approximately 12 inches, moisture conditioned, and compacted.

6.4.9 The site should then be brought to final subgrade elevations with structural fill compacted in layers. In general, soils native to the site are suitable for re-use as fill if free from vegetation, debris and other deleterious material. Layers of fill should be no thicker than will allow for adequate bonding and compaction. All fill, backfill, and scarified ground surfaces should be compacted to a dry density of at least 90 percent of maximum dry density near to slightly above optimum moisture content, as determined in accordance with ASTM Test Procedure D 1557. Fill areas with in-place density test results indicating moisture contents less than optimum will require additional moisture conditioning prior to placing additional fill.

6.4.10 To reduce the potential for differential settlement, it is recommended that the cut portion of building pads with cut-fill transitions be undercut at least 3 feet and replaced, where practical, with “very low” to “medium” expansive compacted fill soils.

6.4.11 Cut pads exposing concretions, cemented material, or expansive soil should be undercut at least 3 feet and replaced with properly compacted “very low” to “medium” expansive soil to facilitate excavation of foundations and shallow utilities.

6.4.12 Undercuts (overexcavations) performed on pads with cut-fill transitions, cemented sandstone, hard rock or expansive soil materials at grade should be undercut at a gradient of 1 percent toward the street or toward the deepest fill area to provide drainage for moisture migration along the contact between the native soil and compacted fill.

6.4.13 The on-site soil is suitable to be used as fill if relatively free of debris and organic material. The depth of removal should be such that dense natural ground is exposed at the base of the overexcavation.

6.4.14 Grading should be performed such that highly expansive soils are placed in the deeper fill areas and outside of slope zones. Materials within 3 feet of finish grade on lots and the upper 12 inches of subgrade within streets, where practical, should consist of very low to medium expansive soils (soil with an Expansion Index less than 90).

6.4.15 Cut and fill slopes should be constructed at an inclination of 2:1 (horizontal to vertical) or flatter. An approximately 15 foot high 1.5:1 cut slope in the Salto Intrusive is planned at the south end of the property, and is considered acceptable. Fill slopes should be constructed of granular material and compacted out to the face of the finish slope. If complete removals cannot be performed outside the toe of slopes due to environmentally sensitive areas, Geocon Incorporated should be consulted to provide recommendations.

6.4.16 Excavations in cemented zones of formational units will likely generate oversize rock chunks. Oversized materials can be placed in fill areas in accordance with the recommendations contained within the *Recommended Grading Specifications* in Appendix D. Oversize materials (rocks or hard lumps in excess of 12 inches in least dimension) should be kept at least 10 feet below proposed finish grade within building pads and at least 2 feet below the deepest utility within street right-of-ways. Modifications to the hold down depths can be made at the owner's desecration.

6.5 Settlement Monitoring

6.5.1 For the areas where total removal of unsuitable soil has not been practical due to presence of groundwater settlement monitoring may be required. The need for settlement monuments will be determined during grading based on the extent of removals that are performed. A typical settlement monument detail is provided in Figure 10. If settlement monuments are placed, they should be "as-built" for location by the civil engineer. Settlement readings (if needed) should be taken weekly until three (3) consecutive readings showing essentially no movement has occurred.

6.6 Slope Stability

6.6.1 Slope stability analyses, utilizing average drained direct shear strength parameters, indicate proposed fill slopes constructed with on-site granular materials and cut slopes within formational material should have calculated factors of safety of at least 1.5 under static conditions with respect to both deep-seated failure and shallow sloughing conditions. Results of the analyses are presented on Figures 11 through 13. Additionally, an inclination of 1.5 to 1 (horizontal to vertical) is acceptable for slopes excavated into the Salto Intrusive provided no adverse jointing or fractures exist. All cut slopes should be observed by a geologist to assess if adverse bedding, jointing, or fractures exist.

6.6.2 There are steep to near vertical cut slopes within the northeast portion of the site. These slopes were excavated during mining operations. The stability of these slopes should be evaluated when ultimate grading and use of this area is known. Various options such as lay back, stability fill or soil nailing/rock bolting may be considered at the time. Alternatively, slope set-backs and rock retention fences can be utilized. For preliminary planning purposes, we recommend a set-back for site improvements of 20 feet from the toe of slope in conjunction with the construction of a debris ditch and rock retention fence. Additionally, we recommend loose rock and accumulated soil on the slope face and at the top of the slope be removed. The construction of the debris ditch and rock retention fence should occur during fine grading of the pad once pad usage and improvement locations have been determined.

6.6.3 The proposed 45 feet high cut slope located at the southwest boundary, adjacent to Simsbury Court, will be excavated into Terrace Deposits. Our large diameter boring LB-2 encountered materials consisting of interbedded silty sand, cohessionless sand and clay layers which were occasionally partially remolded. Our analysis indicates that a buttress fill will be required to provide adequate slope stability. Based on our analysis, the stability buttress will need to have a minimum width of 30 feet to provide adequate stability. A typical buttress fill detail is provided in Figure 14. A discussion our stability analysis is presented in Appendix C.

6.6.4 Excavations including buttresses, shear keys, and stability fills should be observed during grading by an engineering geologist to evaluate whether soil and geologic conditions do not differ significantly from those expected. Buttress shear key and associated subdrains should be surveyed during construction and depicted on the final as-built grading plans.

6.6.5 We performed the slope stability analyses based on the interpretation of geologic conditions encountered during our field investigation. In certain areas, the geologic

conditions such as the localized or continuous features of the bedding plane shears may need to be further defined by additional field exploration based on our review of the 40-scale grading plans.

6.6.6 The outer 15 feet (or a distance equal to the height of the slope, whichever is less) of fill slopes should be composed of properly compacted granular "soil" fill to reduce the potential for surficial sloughing. In general, soil with an Expansion Index of less than 90 will be acceptable in the outer slope zone.

6.6.7 Fill slopes should be overbuilt at least 3 feet and cut back to the design finish grades. Alternatively, fill slopes can be compacted by backrolling with a loaded sheepsfoot roller or tracked walked by sufficiently large equipment at vertical intervals not to exceed 4 feet. Slope should be uniformly compacted to a dry density of at least 90 percent of the laboratory maximum dry density to the face of the finished slope.

6.6.8 All slopes should be landscaped with drought-tolerant vegetation having variable root depths and requiring minimal landscape irrigation. In addition, all slopes should be drained and properly maintained to reduce erosion. Slope planting should generally consist of drought tolerant plants having a variable root depth. Slope watering should be kept to a minimum to just support the plant growth.

6.7 Seismic Design Criteria

6.7.1 We used the computer program *Seismic Hazard Curves and Uniform Hazard Response Spectra*, provided by the USGS. Table 6.7 summarizes site-specific design criteria obtained from the 2010 California Building Code (CBC) (based on the 2009 International Building Code [IBC]), Chapter 16 Structural Design, Section 1613 Earthquake Loads. The short spectral response uses a period of 0.2 second. The building structure and improvements should be designed using a Site Class D using the criteria set forth in Section 1613 of the 2010 California Building Code.

TABLE 6.7
2010 CBC SEISMIC DESIGN PARAMETERS

Parameter	Value	IBC-06 Reference
Site Class	D	Table 1613.5.2
Spectral Response – Class B (0.2 sec), S_S	1.170 g	Figure 1613.5(3)
Spectral Response – Class B (1 sec), S_1	0.445 g	Figure 1613.5(4)
Site Coefficient, F_a	1.032	Table 1613.5.3(1)
Site Coefficient, F_v	1.555	Table 1613.5.3(2)
Maximum Considered Earthquake Spectral Response Acceleration (0.2 sec), S_{MS}	1.208 g	Section 1613.5.3 (Eqn 16-37)
Maximum Considered Earthquake Spectral Response Acceleration – (1 sec), S_{M1}	0.692 g	Section 1613.5.3 (Eqn 16-38)
5% Damped Design Spectral Response Acceleration (0.2 sec), S_{DS}	0.805 g	Section 1613.5.4 (Eqn 16-39)
5% Damped Design Spectral Response Acceleration (1 sec), S_{D1}	0.461 g	Section 1613.5.4 (Eqn 16-40)

6.7.2 Conformance to the criteria in Table 6.7 for seismic design does not constitute any kind of guarantee or assurance that significant structural damage or ground failure will not occur if a maximum level earthquake occurs. The primary goal of seismic design is to protect life and not to avoid all damage, since such design may be economically prohibitive.

6.8 Foundations

6.8.1 We expect conventional shallow foundations will be suitable for support of new structures. Foundation recommendations can be provided in update geotechnical reports specific to planned development and based on as-graded soil conditions in the proposed building area. A report specific to the bridge will be prepared separately.

6.9 Preliminary Retaining Wall Recommendations

6.9.1 Retaining walls that are allowed to rotate more than 0.001H (where H equals the height of the retaining portion of the wall) at the top of the wall and having a level backfill surface should be designed for an active soil pressure equivalent to the pressure exerted by a fluid density of 35 pcf. Where the backfill will be inclined at 2:1 (horizontal:vertical), an active soil pressure of 50 pcf is recommended. Expansive soil should not be used as backfill material behind retaining walls. Soil placed for retaining wall backfill should have an Expansion Index less than 50.

6.9.2 Soil contemplated for use as retaining wall backfill, including import materials, should be identified in the field prior to backfill. At that time, Geocon Incorporated should obtain

samples for laboratory testing to evaluate its suitability. Modified lateral earth pressures may be necessary if the backfill soil does not meet the required expansion index or shear strength. City or regional standard wall designs, if used, are based on a specific active lateral earth pressure and/or soil friction angle. In this regard, on-site soil to be used as backfill may or may not meet the values for standard wall designs. Geocon Incorporated should be consulted to assess the suitability of the on-site soil for use as wall backfill if standard wall designs will be used.

6.9.3 Where walls are restrained from movement at the top, an additional uniform pressure of 8H psf should be added to the active soil pressure where the wall possesses a height of 8 feet or less and 12H where the wall is greater than 8 feet. For retaining walls subject to vehicular loads within a horizontal distance equal to two-thirds the wall height, a surcharge equivalent to 2 feet of fill soil should be added (unit weight 130 pcf).

6.9.4 Retaining walls should be provided with a drainage system adequate to prevent the buildup of hydrostatic forces and should be waterproofed as required by the project architect. The use of drainage openings through the base of the wall (weep holes) is not recommended where the seepage could be a nuisance or otherwise adversely affect the property adjacent to the base of the wall. The above recommendations assume a properly compacted granular (EI of less than 50) free-draining backfill material with no hydrostatic forces or imposed surcharge load. A typical retaining wall drainage detail is presented on Figure 15. If conditions different than those described are expected, or if specific drainage details are desired, Geocon Incorporated should be contacted for additional recommendations.

6.9.5 In general, wall foundations having a minimum depth and width of 1 foot may be designed for an allowable soil bearing pressure of 2,000 psf, provided the soil within 3 feet below the base of the wall has an Expansion Index of less than 90. The recommended allowable soil bearing pressures may be increased by 300 psf and 500 psf for each additional foot of foundation width and depth, respectively, up to a maximum allowable soil bearing pressure of 4,000 psf. The proximity of the foundation to the top of a slope steeper than 3:1 could impact the allowable soil bearing pressure. Therefore, Geocon Incorporated should be consulted where such a condition is expected.

6.9.6 The structural engineer should determine the seismic design category for the project and if retaining walls need to incorporate seismic lateral loads. A seismic load of 15H is recommended for design. The seismic load is dependent on the retained height where H is the height of the wall, in feet, and the calculated load in pounds per square foot (psf). The load should be applied as a triangular distribution with zero load at the top of the wall. The

seismic load was calculated using a peak site acceleration of 0.31g (S_{DS}/2.5) and applying a pseudo-static coefficient of 0.33.

6.9.7 For resistance to lateral loads, an allowable passive earth pressure equivalent to a fluid density of 300 pcf is recommended for footings or shear keys poured neat against properly compacted granular fill soils or undisturbed natural soils. The allowable passive pressure assumes a horizontal surface extending away from the base of the wall at least 5 feet or three times the surface generating the passive pressure, whichever is greater. The upper 12 inches of material not protected by floor slabs or pavement should not be included in the design for lateral resistance. An allowable friction coefficient of 0.4 may be used for resistance to sliding between soil and concrete. This friction coefficient may be combined with the allowable passive earth pressure when determining resistance to lateral loads.

6.9.8 The recommendations presented above are generally applicable to the design of rigid concrete or masonry retaining walls having a maximum height of 18 feet. In the event that walls higher than 18 feet or other types of walls (such as crib or mechanically stabilized earth-type walls) are planned, Geocon Incorporated should be consulted for additional recommendations.

6.10 Detention Basin and Bioswale Recommendations

6.10.1 Any detention basins, bioswales and bio-remediation areas should be designed by the project civil engineer and reviewed by Geocon Incorporated. Typically, bioswales consist of a surface layer of vegetation underlain by clean sand. A subdrain should be provided beneath the sand layer. Prior to discharging into the storm drain pipe, a seepage cutoff wall should be constructed at the interface between the subdrain and storm drain pipe. The concrete cut-off wall should extend at least 6-inches beyond the perimeter of the gravel-packed subdrain system.

6.10.2 Distress may be caused to planned improvements and properties located hydrologically downstream or adjacent to these devices. The distress depends on the amount of water to be detained, its residence time, soil permeability, and other factors. We have not performed a hydrogeology study at the site. Downstream and adjacent properties may be subjected to seeps, springs, slope instability, raised groundwater, movement of foundations and slabs, or other impacts as a result of water infiltration. Due to site soil and geologic conditions, permanent bioswales and bio-remediation areas should be lined with an impermeable barrier, such as a thick visqueen, to prevent water infiltration in to the underlying compacted fill. Temporary detention basins in areas where improvements have not been constructed do not need to be lined.

6.10.3 The landscape architect should be consulted to provide the appropriate plant recommendations. If drought resistant plants are not used, irrigation may be required.

6.11 Site Drainage and Moisture Protection

6.11.1 Adequate site drainage is critical to reduce the potential for differential soil movement, erosion and subsurface seepage. Under no circumstances should water be allowed to pond adjacent to footings. The site should be graded and maintained such that surface drainage is directed away from structures in accordance with 2010 CBC 1803.3 or other applicable standards. In addition, surface drainage should be directed away from the top of slopes into swales or other controlled drainage devices. Roof and pavement drainage should be directed into conduits that carry runoff away from the proposed structure.

6.11.2 In the case of basement walls or building walls retaining landscaping areas, a water-proofing system should be used on the wall and joints, and a Miradrain drainage panel (or similar) should be placed over the waterproofing. The project architect or civil engineer should provide detailed specifications on the plans for all waterproofing and drainage.

6.11.3 Underground utilities should be leak free. Utility and irrigation lines should be checked periodically for leaks, and detected leaks should be repaired promptly. Detrimental soil movement could occur if water is allowed to infiltrate the soil for prolonged periods of time.

6.11.4 Adequate drainage provisions are imperative. Under no circumstances should water be allowed to pond adjacent to footings. The building pads should be properly finish graded after the buildings and other improvements are in place so that drainage water is directed away from foundations, pavements, concrete slabs, and slope tops to controlled drainage devices.

LIMITATIONS AND UNIFORMITY OF CONDITIONS

1. The firm that performed the geotechnical investigation for the project should be retained to provide testing and observation services during construction to provide continuity of geotechnical interpretation and to check that the recommendations presented for geotechnical aspects of site development are incorporated during site grading, construction of improvements, and excavation of foundations. If another geotechnical firm is selected to perform the testing and observation services during construction operations, that firm should prepare a letter indicating their intent to assume the responsibilities of project geotechnical engineer of record. A copy of the letter should be provided to the regulatory agency for their records. In addition, that firm should provide revised recommendations concerning the geotechnical aspects of the proposed development, or a written acknowledgement of their concurrence with the recommendations presented in our report. They should also perform additional analyses deemed necessary to assume the role of Geotechnical Engineer of Record.

2. The recommendations of this report pertain only to the site investigated and are based upon the assumption that the soil conditions do not deviate from those disclosed in the investigation. If any variations or undesirable conditions are encountered during construction, or if the proposed construction will differ from that anticipated herein, Geocon Incorporated should be notified so that supplemental recommendations can be given. The evaluation or identification of the potential presence of hazardous or corrosive materials was not part of the scope of services provided by Geocon Incorporated.

3. This report is issued with the understanding that it is the responsibility of the owner or his representative to ensure that the information and recommendations contained herein are brought to the attention of the architect and engineer for the project and incorporated into the plans, and the necessary steps are taken to see that the contractor and subcontractors carry out such recommendations in the field.

4. The findings of this report are valid as of the present date. However, changes in the conditions of a property can occur with the passage of time, whether they be due to natural processes or the works of man on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and should not be relied upon after a period of three years.

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VICINITY MAP

QUARRY CREEK II
CARLSBAD, CALIFORNIA

DATE 05 - 11 - 2012	PROJECT NO. 07135 - 42 - 03	FIG. 1

Vicinity Map

GRAPHIC SCALE
0' 50' 100' 150' 200' 300' 400'
SCALE 1"= 100'

GEOCON LEGEND

- Qudf ..... UNDOCUMENTED FILL (Dotted Where Buried)
- Qcf ..... COMPACTED FILL (Dotted Where Buried)
- Qpcf ..... PREVIOUSLY COMPACTED FILL (Dotted Where Buried)
- Qpf ..... PREVIOUSLY PLACED FILL (Dotted Where Buried)
- Qal ..... ALLUVIUM (Dotted Where Buried)
- Qcol ..... COLLUVIUM
- Qlsf ..... SURFICIAL LANDSLIDE
- Qt ..... TERRACE DEPOSIT (Dotted Where Buried)
- Tv ..... VOLCANIC ROCK (Dotted Where Buried)
- Ts ..... SANTIAGO FORMATION (Dotted Where Buried)
- Jspi ..... SALTO INTRUSIVE (Dotted Where Buried)
- ..... APPROX. LOCATION OF GEOLOGIC CONTACT (Dotted Where Buried, Queried Where Uncertain)
- T-22 ..... APPROX. LOCATION OF EXPLORATORY TRENCH
- T-10 ..... APPROX. LOCATION OF EXPLORATORY TRENCH (Geocon 09-10-2009)
- T-11C ..... APPROX. LOCATION OF EXPLORATORY BACKHOE TRENCH (Limited Investigation to Evaluate Hardrock Constraints, Geocon 09-10-2009)
- LB-5 ..... APPROX. LOCATION OF LARGE DIAMETER BORING
- SB-6 ..... APPROX. LOCATION OF SMALL DIAMETER BORING (2004)
- (>13.5) ..... APPROX. THICHNESS OF SURFICIAL SOIL (Feet)
- [157] ..... APPROX. ELEVATION TO BOTTOM OF SURFICIAL SOIL (MSL)
- ..... APPROX. LOCATION OF PROPOSED SUBDRAIN
- ..... APPROX. LOCATION OF EXISTING SUBDRAIN
- B B' ..... APPROX. LOCATION OF GEOLOGIC CROSS SECTION
- ..... FAULT
- ..... BUTTRESS FILL

GEOLOGIC MAP

QUARRY CREEK II
CARLSBAD, CALIFORNIA

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SCALE	1" = 100'	DATE	05 - 11 - 2012
PROJECT NO.	07135 - 42 - 03	FIGURE	2
SHEET	1 OF 2		

Y:\PROJECTS\07135-42-03 (Quarry Creek II)\SHEETS\07135-42-03 Geo Map2.dwg

GEOCON LEGEND

- Qudf .....UNDOCUMENTED FILL (Dotted Where Buried)
- Qcf .....COMPACTED FILL (Dotted Where Buried)
- Qpcf .....PREVIOUSLY COMPACTED FILL (Dotted Where Buried)
- Qpf .....PREVIOUSLY PLACED FILL (Dotted Where Buried)
- Qal .....ALLUVIUM (Dotted Where Buried)
- Qcol .....COLLUVIUM
- Qlsf .....SURFICIAL LANDSLIDE
- Qt .....TERRACE DEPOSIT (Dotted Where Buried)
- Tv .....VOLCANIC ROCK (Dotted Where Buried)
- Ts .....SANTIAGO FORMATION (Dotted Where Buried)
- Jspi .....SALTO INTRUSIVE (Dotted Where Buried)
- .....APPROX. LOCATION OF GEOLOGIC CONTACT (Dotted Where Buried, Queried Where Uncertain)
- T-22 .....APPROX. LOCATION OF EXPLORATORY TRENCH
- T-10 .....APPROX. LOCATION OF EXPLORATORY TRENCH (Geocon 09-10-2009)
- T-11C .....APPROX. LOCATION OF EXPLORATORY BACKHOE TRENCH (Limited Investigation to Evaluate Hardrock Constraints, Geocon 09-10-2009)
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- (>13.5) .....APPROX. THICHNESS OF SURFICIAL SOIL (Feet)
- [157] .....APPROX. ELEVATION TO BOTTOM OF SURFICIAL SOIL (MSL)
- .....APPROX. LOCATION OF PROPOSED SUBDRAIN
- .....APPROX. LOCATION OF EXISTING SUBDRAIN
- B B' .....APPROX. LOCATION OF GEOLOGIC CROSS SECTION
- .....FAULT
- .....BUTTRESS FILL

GEOLOGIC MAP

QUARRY CREEK II
CARLSBAD, CALIFORNIA

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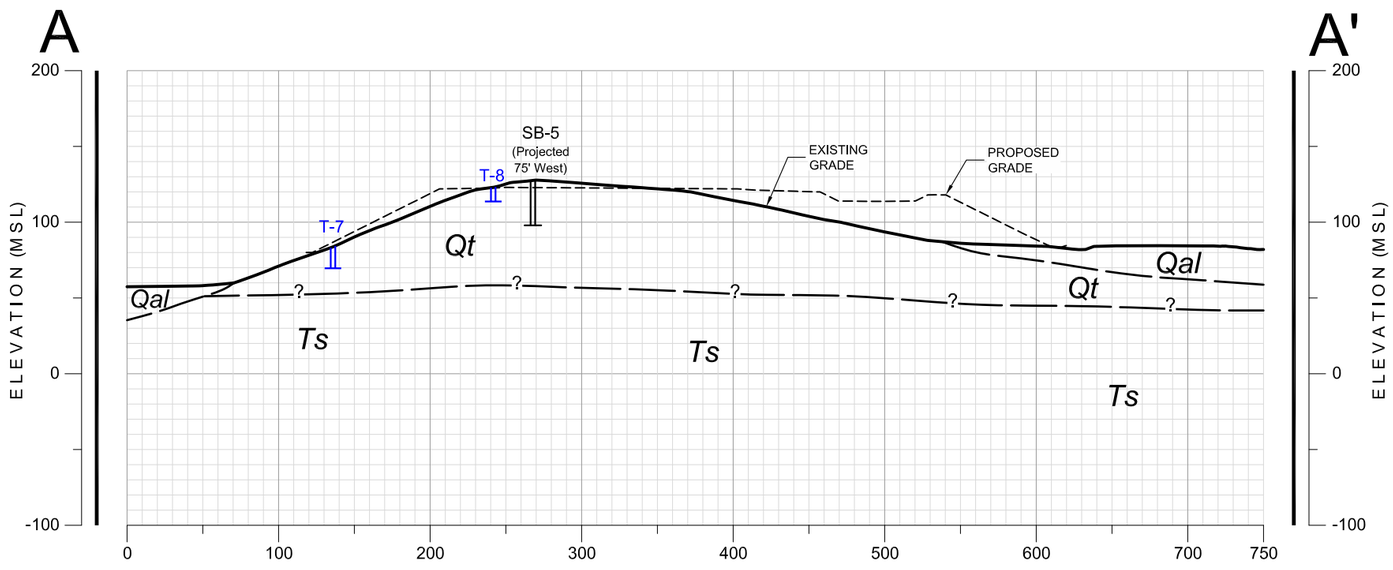
SCALE	1" = 100'	DATE	05 - 11 - 2012
PROJECT NO.	07135 - 42 - 03	FIGURE	3
SHEET	2 OF 2		

Y:\PROJECTS\07135-42-03 (Quarry Creek II)\SHEETS\07135-42-03 Geo Map3.dwg

QUARRY CREEK II
CARLSBAD, CALIFORNIA



GEOLOGIC CROSS-SECTION A-A′

SCALE: 1" = 100' (Vert. = Horiz.)

GEOCON LEGEND

Qal.....ALLUVIUM (Dotted Where Buried)

Qt.....TERRACE DEPOSIT (Dotted Where Buried)

Ts.....SANTIAGO FORMATION (Dotted Where Buried)

~?~.....APPROX. LOCATION OF GEOLOGIC CONTACT Queried Where Uncertain)

T-8 .....APPROX. LOCATION OF EXPLORATORY TRENCH

B-2 .....APPROX. LOCATION OF LARGE DIAMETER BORING

SB-4 .....APPROX. LOCATION OF SMALL DIAMETER BORING (2004)

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PROJECT NO. 07135 - 42 - 03
FIGURE 4
DATE 05 - 11 - 2012

LADRILLONO

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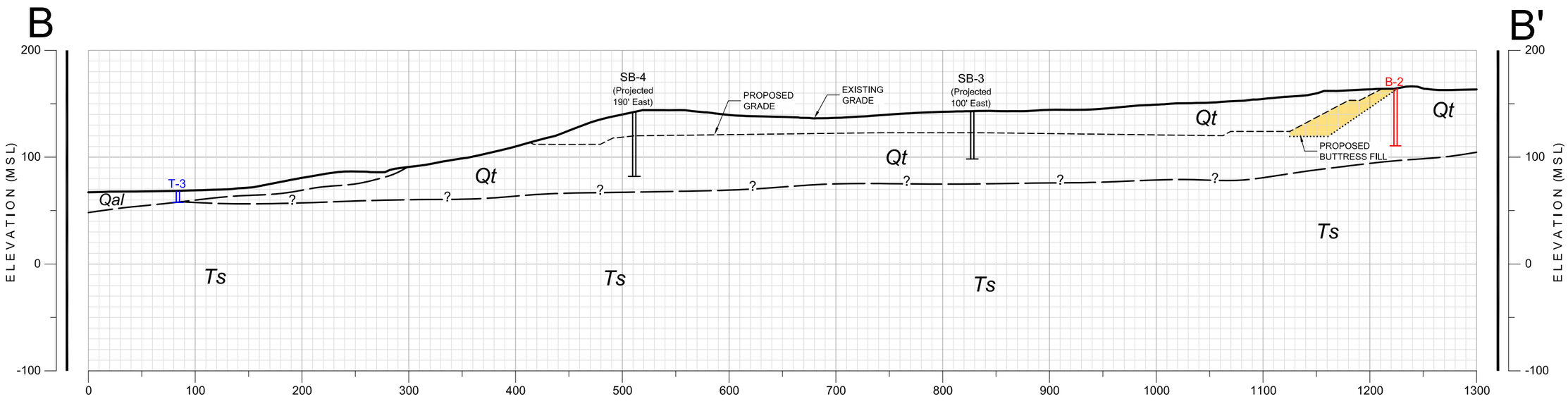
QUARRY CREEK II
CARLSBAD, CALIFORNIA



GEOLOGIC CROSS-SECTION B-B'

SCALE: 1" = 100' (Vert. = Horiz.)

GEOCON LEGEND

Qal.....ALLUVIUM (Dotted Where Buried)

Qt.....TERRACE DEPOSIT (Dotted Where Buried)

Ts.....SANTIAGO FORMATION (Dotted Where Buried)

~2~.....APPROX. LOCATION OF GEOLOGIC CONTACT Queried Where Uncertain)

T-8 .....APPROX. LOCATION OF EXPLORATORY TRENCH

B-2 .....APPROX. LOCATION OF LARGE DIAMETER BORING

SB-4 .....APPROX. LOCATION OF SMALL DIAMETER BORING (2004)

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FIGURE 5
DATE 05 - 11 - 2012

LADRILLONO

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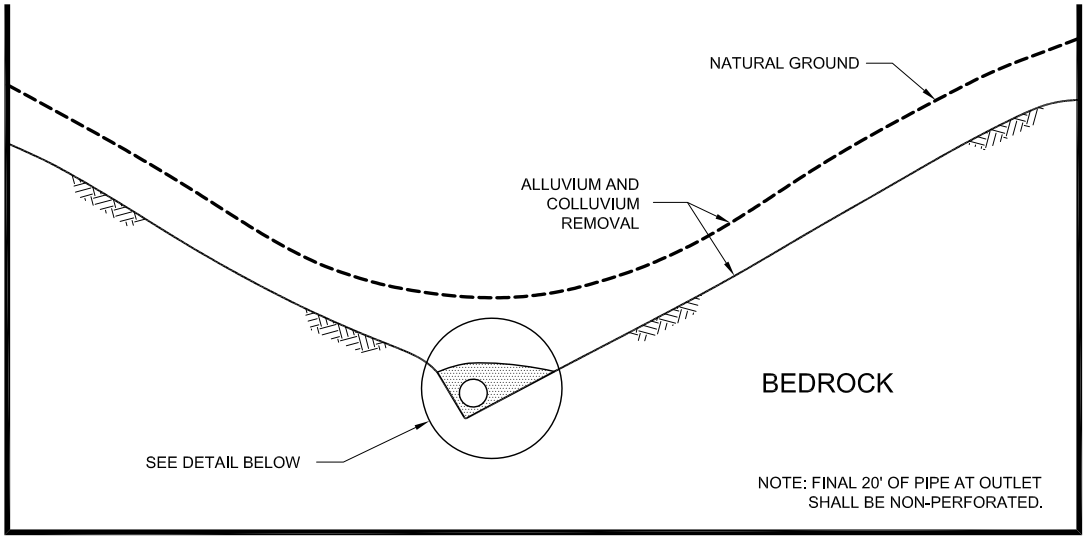

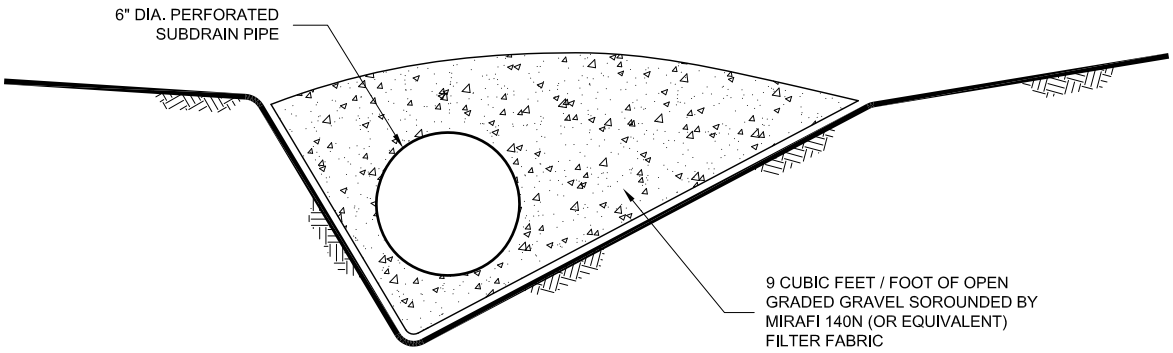

NOTES:

1.....6-INCH DIAMETER, SCHEDULE 40 PVC PERFORATED PIPE.

NO SCALE

TYPICAL CANYON SUBDRAIN DETAIL

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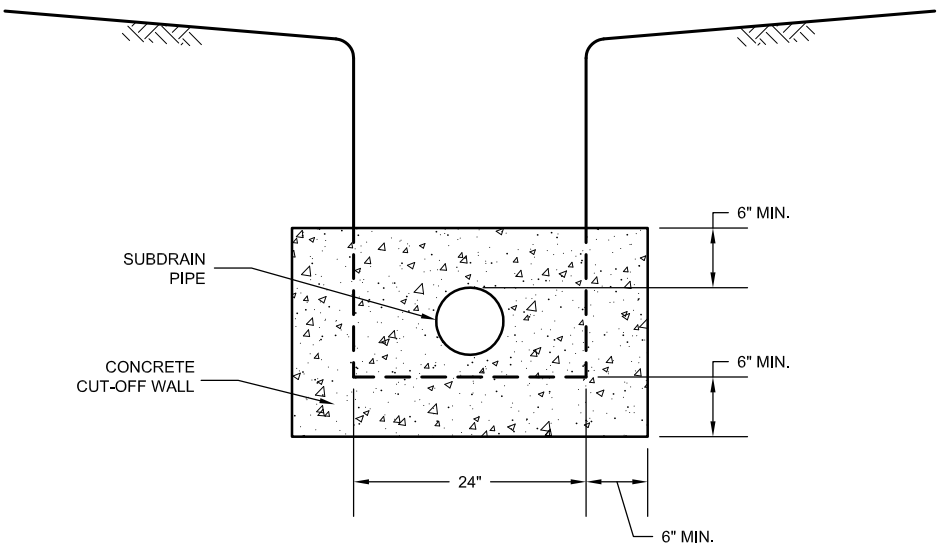
QUARRY CREEK II
CARLSBAD, CALIFORNIA

DATE 05 - 11 - 2012	PROJECT NO. 07135 - 42 - 03	FIG. 6

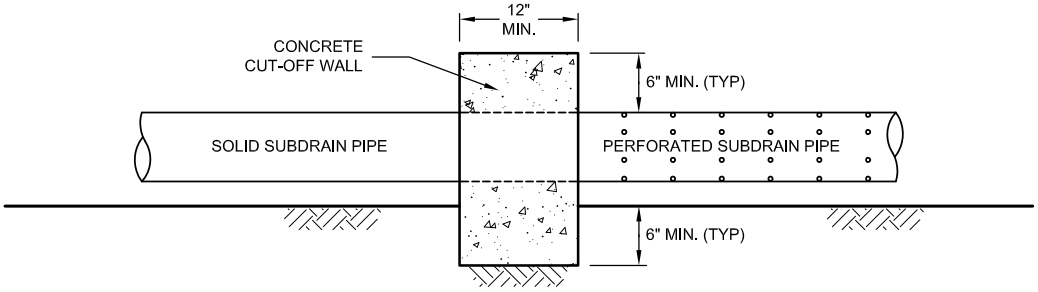
E:/GEOTECH/TYP/CYNDTAIL/aml

FRONT VIEW



NO SCALE

SIDE VIEW



NO SCALE

TYPICAL SUBDRAIN CUT-OFF WALL DETAIL

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QUARRY CREEK II
CARLSBAD, CALIFORNIA

DATE 05 - 11 - 2012	PROJECT NO. 07135 - 42 - 03	FIG. 7

RSCOW

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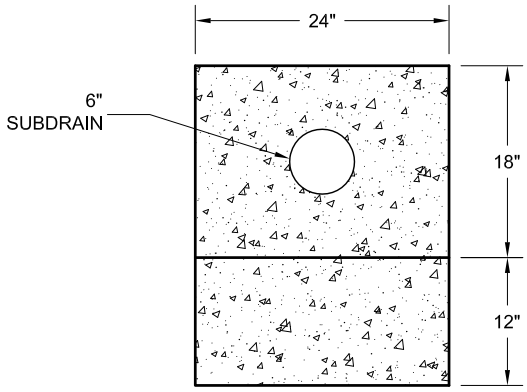
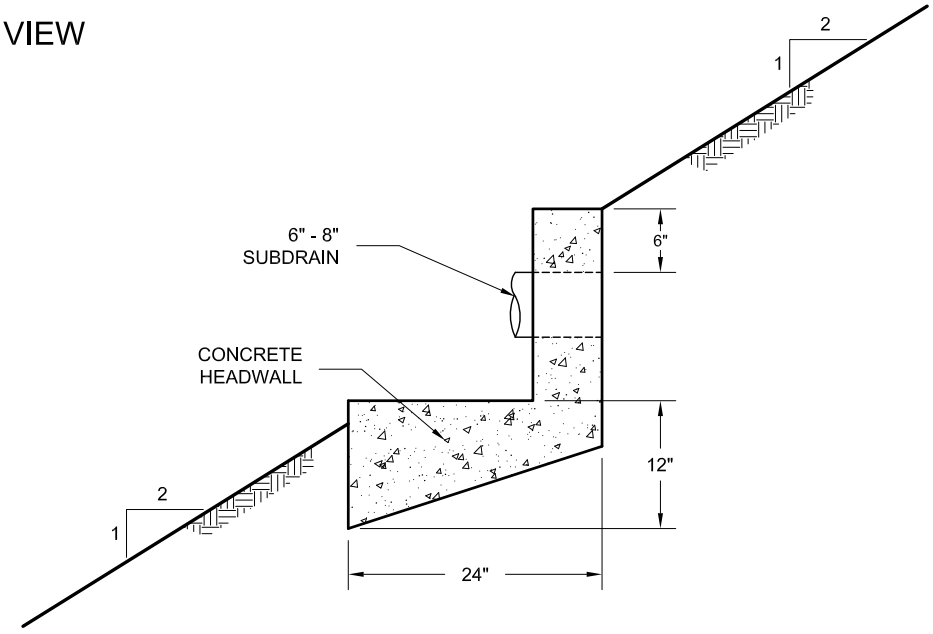
FRONT VIEW



NO SCALE

SIDE VIEW



NOTE: HEADWALL SHOULD OUTLET INTO CONTROLLED SURFACE DRAINAGE

NO SCALE

TYPICAL SUBDRAIN OUTLET HEADWALL DETAIL

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AS / AML		DSK/GTYPD

QUARRY CREEK II
CARLSBAD, CALIFORNIA

DATE 05 - 11 - 2012	PROJECT NO. 07135 - 42 - 03	FIG. 8

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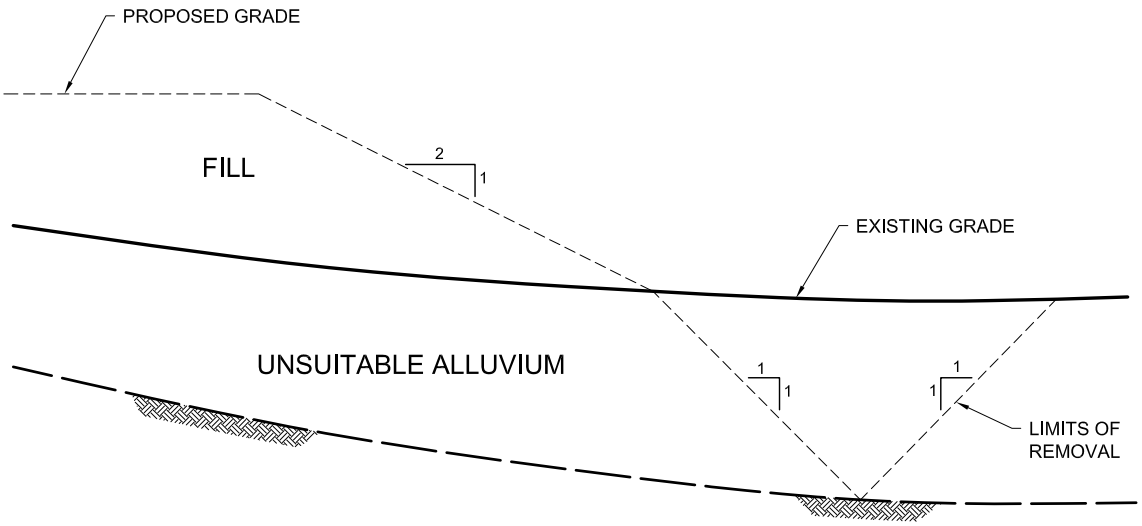

LEFT-IN-PLACE
FORMATIONAL MATERIAL
OR ALLUVIUM WITHIN 3 FEET
OF GROUNDWATER AND BELOW

NOT TO SCALE

NOTE:

SLOPE OF BACKCUT MAY BE STEEPENED WITH THE APPROVAL OF THE SOILS ENGINEER WHERE BOUNDARY CONSTRAINTS LIMIT EXTENT OF REMOVALS

CONSTRUCTION DETAIL FOR LATERAL EXTENT OF REMOVAL

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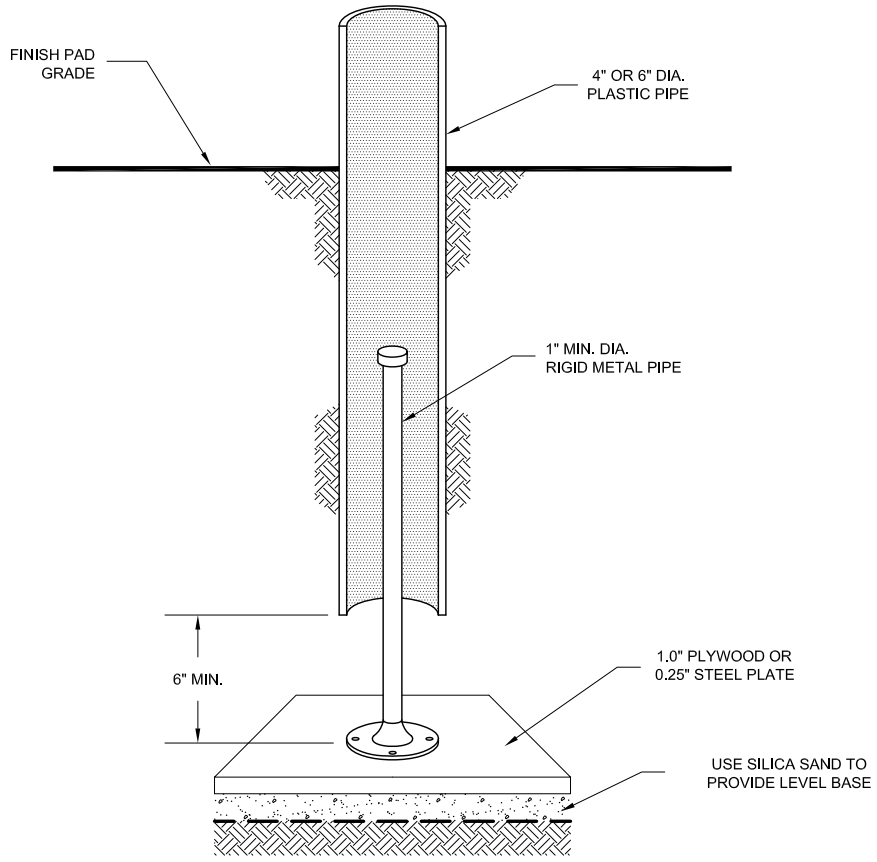
AS / AML		DSK/GTYPD

QUARRY CREEK II
CARLSBAD, CALIFORNIA

DATE 05 - 11 - 2012	PROJECT NO. 07135 - 42 - 03	FIG. 9

CDFLER.DWG/aml



NOTES:

NO SCALE

1.....LOCATION OF SETTLEMENT PLATES SHALL BE CLEARLY MARKED AND READILY VISIBLE (RED FLAG) TO EQUIPMENT OPERATORS.

2.....CONTRACTOR SHALL MAINTAIN 10-FOOT HORIZONTAL CLEARANCE FOR HEAVY EQUIPMENT WITHIN 5 FEET (VERTICAL) OF PLATE BASE. FILL WITHIN CLEARANCE AREA SHALL BE HAND COMPACTED TO PROJECT SPECIFICATIONS OR COMPACTED BY ALTERNATIVE APPROVED SOILS ENGINEER.

3.....AFTER 5 FEET (VERTICAL) OF FILL IS IN PLACE, THE CONTRACTOR SHALL MAINTAIN 5 FEET HORIZONTAL EQUIPMENT CLEARANCE. FILL IN CLEARANCE AREA SHALL BE HAND COMPACTED (OR APPROVED ALTERNATIVE) IN VERTICAL INCREMENTS NOT TO EXCEED 2 FEET.

4.....IN THE EVENT OF DAMAGE TO SETTLEMENT PLATE OR EXTENSION RESULTING FROM EQUIPMENT OPERATING WITHIN PRESCRIBED CLEARANCE AREA, CONTRACTORS SHALL IMMEDIATELY NOTIFY SOILS ENGINEER AND SHALL BE RESPONSIBLE FOR RESTORING THE SETTLEMENT PLATES TO WORKING ORDER.

SETTLEMENT MONUMENT

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QUARRY CREEK II
CARLSBAD, CALIFORNIA

DATE 05 - 11 - 2012	PROJECT NO. 07135 - 42 - 03	FIG. 10

ASSUMED CONDITIONS :

SLOPE HEIGHT	H	= 50 feet
SLOPE INCLINATION	2 : 1	(Horizontal : Vertical)
TOTAL UNIT WEIGHT OF SOIL	γ_t	= 130 pounds per cubic foot
ANGLE OF INTERNAL FRICTION	ϕ	= 32 degrees
APPARENT COHESION	C	= 300 pounds per square foot
NO SEEPAGE FORCES		

ANALYSIS :

$\gamma_{c\phi}$	=	$\frac{\gamma H \tan\phi}{C}$	EQUATION (3-3), REFERENCE 1
FS	=	$\frac{NcfC}{\gamma H}$	EQUATION (3-2), REFERENCE 1
$\gamma_{c\phi}$	=	13.5	CALCULATED USING EQ. (3-3)
Ncf	=	40	DETERMINED USING FIGURE 10, REFERENCE 2
FS	=	1.84	FACTOR OF SAFETY CALCULATED USING EQ. (3-2)

REFERENCES :

1.....Janbu, N., Stability Analysis of Slopes with Dimensionless Parameters, Harvard Soil Mechanics, Series No. 46, 1954

2.....Janbu, N., Discussion of J.M. Bell, Dimensionless Parameters for Homogeneous Earth Slopes, Journal of Soil Mechanics and Foundation Design, No. SM6, November 1967.

SLOPE STABILITY ANALYSIS - CUT SLOPES

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QUARRY CREEK II
CARLSBAD, CALIFORNIA

DATE 05 - 11 - 2012	PROJECT NO. 07135 - 42 - 03	FIG. 11

ASSUMED CONDITIONS :

SLOPE HEIGHT	H	= 50 feet
SLOPE INCLINATION	2 : 1	(Horizontal : Vertical)
TOTAL UNIT WEIGHT OF SOIL	γ_t	= 130 pounds per cubic foot
ANGLE OF INTERNAL FRICTION	ϕ	= 30 degrees
APPARENT COHESION	C	= 300 pounds per square foot
NO SEEPAGE FORCES		

ANALYSIS :

$\gamma_{c\phi}$	=	$\frac{\gamma H \tan\phi}{C}$	EQUATION (3-3), REFERENCE 1
FS	=	$\frac{NcfC}{\gamma H}$	EQUATION (3-2), REFERENCE 1
$\gamma_{c\phi}$	=	12.5	CALCULATED USING EQ. (3-3)
Ncf	=	35	DETERMINED USING FIGURE 10, REFERENCE 2
FS	=	1.61	FACTOR OF SAFETY CALCULATED USING EQ. (3-2)

REFERENCES :

1.....Janbu, N., Stability Analysis of Slopes with Dimensionless Parameters, Harvard Soil Mechanics, Series No. 46, 1954

2.....Janbu, N., Discussion of J.M. Bell, Dimensionless Parameters for Homogeneous Earth Slopes, Journal of Soil Mechanics and Foundation Design, No. SM6, November 1967.

SLOPE STABILITY ANALYSIS - FILL SLOPES

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QUARRY CREEK II
CARLSBAD, CALIFORNIA

DATE 05 - 11 - 2012	PROJECT NO. 07135 - 42 - 03	FIG. 12

ASSUMED CONDITIONS :

SLOPE HEIGHT	H	=	Infinite
DEPTH OF SATURATION	Z	=	3 feet
SLOPE INCLINATION	2 : 1 (Horizontal : Vertical)		
SLOPE ANGLE	i	=	26.6 degrees
UNIT WEIGHT OF WATER	γ_w	=	62.4 pounds per cubic foot
TOTAL UNIT WEIGHT OF SOIL	γ_t	=	130 pounds per cubic foot
ANGLE OF INTERNAL FRICTION	ϕ	=	30 degrees
APPARENT COHESION	C	=	300 pounds per square foot

SLOPE SATURATED TO VERTICAL DEPTH Z BELOW SLOPE FACE

SEEPAGE FORCES PARALLEL TO SLOPE FACE

ANALYSIS :

$$FS = \frac{C + (\gamma_t - \gamma_w)\ Z\ \cos^2 i\ \tan \phi}{\gamma_t\ Z\ \sin i\ \cos i} = 3.0$$

REFERENCES :

1.....Haefeli, R. *The Stability of Slopes Acted Upon by Parallel Seepage*, Proc. Second International Conference, SMFE, Rotterdam, 1948, 1, 57-62

2.....Skempton, A. W., and F.A. Delory, *Stability of Natural Slopes in London Clay*, Proc. Fourth International Conference, SMFE, London, 1957, 2, 378-81

SURFICIAL SLOPE STABILITY ANALYSIS

GEOCON INCORPORATED

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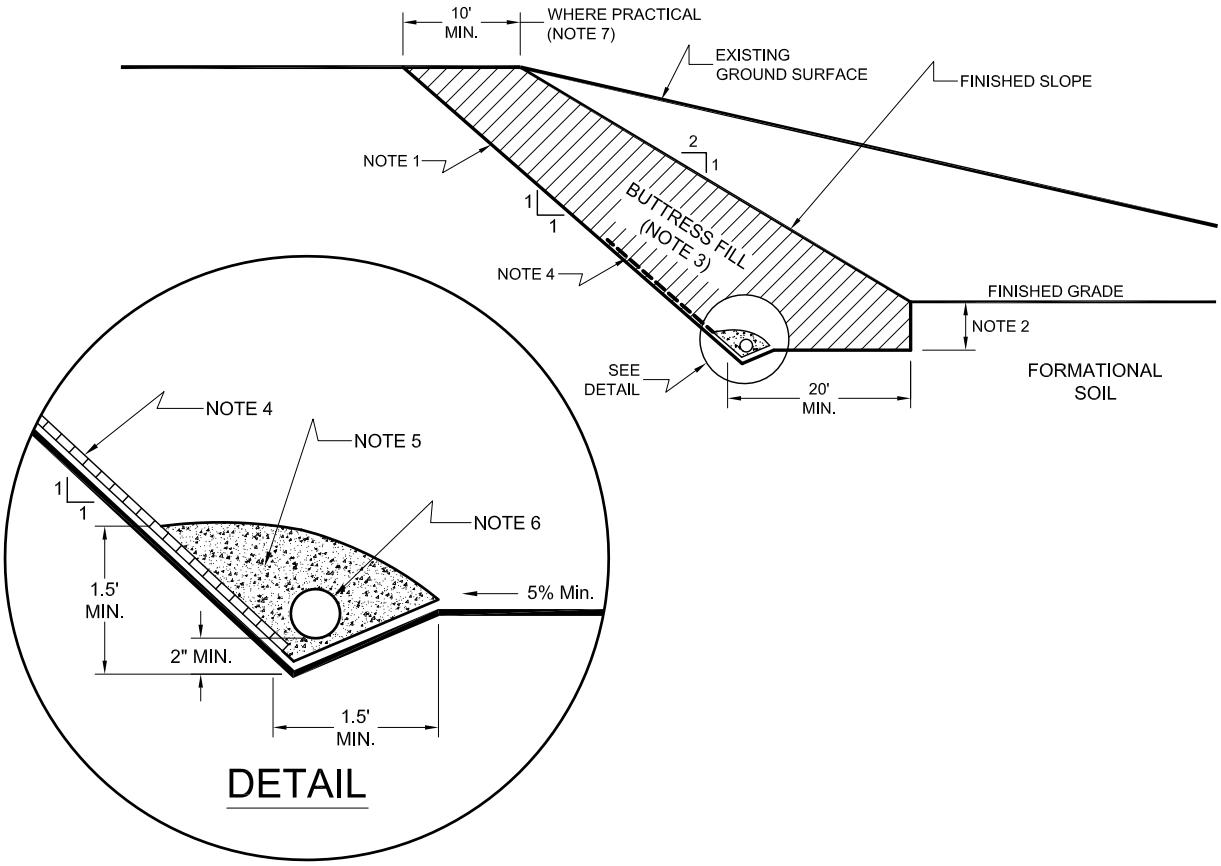
AS / AML		DSK/E0000

QUARRY CREEK II
CARLSBAD, CALIFORNIA

DATE 05 - 11 - 2012	PROJECT NO. 07135 - 42 - 03	FIG. 13



NOTES:

1.....EXCAVATE BACKCUT AT 1:1 INCLINATION OR FLATTER.

2.....BASE OF BUTTRESS FILL TO BE AT LEAST 3 FEET INTO DENSE, FORMATIONAL SOILS SLOPING A MINIMUM 5% INTO SLOPE.

3.....BUTTRESS FILL TO BE COMPOSED OF PROPERLY COMPACTED GRANULAR SOIL WITH MINIMUM SHEAR STRENGTH OF ϕ =30º, C' = 3000 psf.

4.....WHERE SEEPAGE IS ENCOUNTERED IN BACKCUT, CHIMNEY DRAINS TO BE APPROVED PREFABRICATED CHIMNEY DRAIN PANELS (MIRADRAIN, TENSAR, OR EQUIVALENT) SPACED APPROXIMATELY 30 FEET CENTER TO CENTER OR 12-INCH BY 24-INCH SLOTS FILLED WITH FILTER MATERIAL (SEE NOTES). DRAINS WILL BE REQUIRED WHERE AREAS OF SEEPAGE ARE ENCOUNTERED.

5.....FILTER MATERIAL TO BE 1-INCH, OPEN-GRADED CRUSHED ROCK ENCLOSED IN APPROVED FILTER FABRIC.

6.....COLLECTOR PIPE TO BE 4-INCH MINIMUM DIAMETER, PERFORATED, THICK-WALLED PVC SCHEDULE 40 OR EQUIVALENT, AND SLOPED TO DRAIN AT 1 PERCENT MINIMUM TO APPROVED OUTLET. CHIMNEY DRAINS MAY BE REQUIRED IF AREAS OF ACTIVE SEEPAGE ARE ENCOUNTERED.

7.....IF HORIZONTAL EXTENT OF GRADING CONSTRAINED (e.g., THE PRESENCE OF A PROPERTY LINE) THE SLOPE SHOULD BE OVERBUILT, AT LEAST 4 FEET, AND TRIMMED BACK.

NO SCALE

TYPICAL BUTTRESS FILL DETAIL

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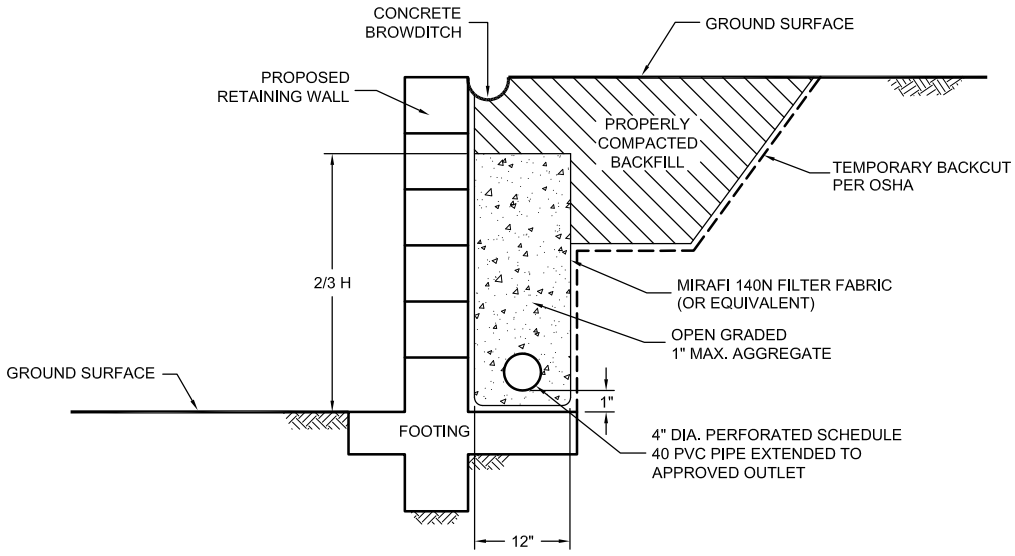
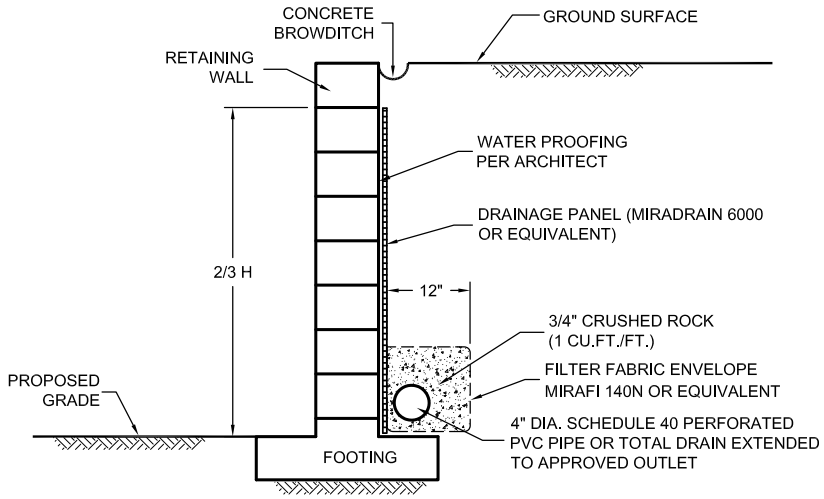
QUARRY CREEK II
CARLSBAD, CALIFORNIA

DATE 05 - 11 - 2012	PROJECT NO. 07135 - 42 - 03	FIG. 14

STABFIL5.DWG

Y:/PROJECTS/07135-42-03 (Quarry Creek III)/DETAILS/STABFIL5.dwg





NOTE :

DRAIN SHOULD BE UNIFORMLY SLOPED TO GRAVITY OUTLET
OR TO A SUMP WHERE WATER CAN BE REMOVED BY PUMPING

NO SCALE

TYPICAL RETAINING WALL DRAIN DETAIL

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QUARRY CREEK II
CARLSBAD, CALIFORNIA

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DATE 05 - 11 - 2012	PROJECT NO. 07135 - 42 - 03	FIG. 15

RWDD7

APPENDIX A

APPENDIX A

FIELD INVESTIGATION

Fieldwork for our investigation included site visits, subsurface exploration, and soil sampling. The locations of the exploratory excavations are shown on the Geologic Map, Figure 2. Boring and trench were mainly excavated within the western portion of the project site. The logs of the excavations and an explanation of the geologic units encountered are presented in figures following the text in this appendix. We located the borings in the field using a measuring tape and existing reference points; therefore, actual boring locations may deviate slightly.

We performed a field investigation on December 20 and 21, 2011, which consisted of drilling five large diameter exploratory borings to a maximum depth of approximately 56 feet below existing grade with an EZ Bore 2000 drill rig equipped with a 30-inch-diameter bucket auger. We obtained bulk and ring samples from the exploratory borings for future laboratory testing.

We have also excavated 22 exploratory trenches to help mapping the surficial soils by using a John Deer 450 trackhoe. Bulk samples and relatively undisturbed chunk samples of prevailing soils were obtained for laboratory testing.

As part of our previous study of the project site, Geocon had excavated 6 small diameter borings in the western portion of the site. The results were reported in 2004 (See list of references). We have included the boring logs herein.

We obtained samples during our boring excavations using a California Sampler. The California sampler is composed of steel and is driven to obtain the soil ring samples. The California sampler has an inside diameter of 2.5 inches and an outside diameter of 2.875 inches. Up to 18 rings that are 2.4 inches in diameter and 1 inch in height are placed inside the sampler. We retained ring samples at appropriate intervals in moisture-tight containers and transported the samples to the laboratory for testing. We also obtained bulk samples from the borings for laboratory testing. The type of sample is noted on the exploratory boring logs.

The Modified California Sampler was driven 12 inches into the bottom of the excavations with the use of the kelly bar and driven into the bottom of the excavation using the kelly bar (weight ranging from approximately 4,500 to 2,500 pound) with a 12-inch drop. Blow counts are recorded. The penetration resistances shown on the boring logs are shown in terms of blows per foot. The blow count values are not to be taken as N-values as adjustments have not been applied. We estimated

elevations shown on the boring logs either from a topographic map or by using a benchmark. Each excavation was backfilled as noted on the boring logs.

We visually examined the soil conditions encountered within the borings, classified, and logged in general accordance with the Unified Soil Classification System (USCS). Logs of the borings are presented on Figures A-1 through A-33. The logs depict the general soil and geologic conditions encountered and the depth at which we obtained the samples.

PROJECT NO. 07135-42-03

BORING LB 1

ELEV. (MSL.) **134'** DATE COMPLETED **12-21-2011**

EQUIPMENT **30" DIAM. BUCKET RIG** BY: **A. SADR**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**TERRACE DEPOSITS** Dense, damp to moist, dark brown, Silty, fine to medium SAND; mottled-weathered			
2					-Becomes less silty with depth			
4				SP	Becomes light brown, fine to medium SAND; trace silt interbedded with medium coarse cohesionless sand			
6	LB1-1					1		
8					-Layer of coarse sand cohesionless; 1 foot thick, horizontal			
10	LB1-2			SP-SM	Dense, moist, grayish brown, fine to medium, Silty SAND; micaceous	2	103.4	2.8
12					-Cross-bedded at 11 to 12 feet -A layer of fine sand, heavy managnese staining from 12-13 feet; horizontal			
14					-Becomes interbedded fine silty sand with fine to medium sand; horizontal contact			
16	LB1-3					3	125.7	9.8
18				SM	Dense, wet, light brown/grayish gray, Silty, fine SAND			
20	LB1-4			SP	Becomes fine to coarse cohesionless SAND	2	103.0	5.4
22	LB1-5				-A thin layer of silt and gravel 6" thick at 23 feet			

Figure A-1,
Log of Boring LB 1, Page 1 of 2

07135-42-03.GPJ

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07135-42-03

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	**BORING LB 1** ELEV. (MSL.) **134'** DATE COMPLETED **12-21-2011** EQUIPMENT **30" DIAM. BUCKET RIG** BY: **A. SADR**	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
24				SM-SP	Dense, wet, brown, slightly Silty, fine to medium SAND; grades to cohesionless fine to medium sand, cross-bedded			
	LB1-6				Dense, wet, brown, slightly Silty, fine to medium SAND; grades to cohesionless fine to medium sand, cross-bedded	2		
26								
28								
30					BORING TERMINATED AT 30 FEET Backfilled with cuttings			

Figure A-1,
Log of Boring LB 1, Page 2 of 2

07135-42-03.GPJ

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◪ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. 07135-42-03

BORING LB 2

ELEV. (MSL.) **167'** DATE COMPLETED **12-21-2011**

EQUIPMENT **30" DIAM. BUCKET RIG** BY: **A. SADR**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SC	**TOPSOIL/COLLUVIUM** Stiff, wet, dark brown, Sandy CLAY with roots to 2 feet			
2								
4				SC	**TERRACE DEPOSITS** Dense, moist, dark brown, Clayey, fine to medium SAND -Stiff, wet, gray, clayey layer 1-2 inch thick, partially remolded, horizontal -Becomes very dark brown			
6	LB2-1				-Light brown to gray clay formed along fractures and random spots, from 6 to 10 feet	2	123.1	13.7
8								
10	LB2-2			CL	Very stiff, wet, dark gray, CLAY, shiny parting surfaces, slickensided, partially remolded -Very dense, moist, brown, fine to coarse SAND, 1 foot thick-lens, north side of boring	3	108.8	16.3
12								
14				SC	Grades into dark brown, Clayey SAND with occasional lenses of clay			
16	LB2-3				-Becomes sandier	2	113.5	16.9
				SM-SP	Interbeds of cohesionless SAND and dark gray Silty SAND			
18	LB2-4			SM	Grades into dense, brown, Silty, fine to medium SAND; uniform			
20	LB2-5				-Dark gray clay lense, 4-6 inch thick at 19 feet	2	116.7	103.4
22								

Figure A-2,
Log of Boring LB 2, Page 1 of 3

07135-42-03.GPJ

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◪ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07135-42-03

BORING LB 2

ELEV. (MSL.) **167'** DATE COMPLETED **12-21-2011**

EQUIPMENT **30" DIAM. BUCKET RIG** BY: **A. SADR**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
24								
	LB2-6					2	103.4	9.1
26				ML-SP	Interbeded stiff, moist, dark grayish brown, SILT and medium brown and gray cohesionless, fine to medium SAND			
				CL	Very stiff, moist, dark grayish brown, Sandy CLAY, shiny parting surface, no shearing evident, approximately 1 foot thick			
28				SM-SP	Dense, moist, medium brown, fine to medium, Silty SAND, grades into cohesionless SAND from 29 feet -Contact N55E, 10NW			
30	LB2-7			CL	Hard, wet, dark brown, Silty CLAY, shiny parting surface	2	98.1	28.5
32				SP	Very dense, moist, brown, cohesionless SAND, sharp contact; one foot thick at 32 feet			
	LB2-8			CL	Hard, moist, dark brown, Sandy CLAY, shiny parting surfaces, carbonate spots and iron staining			
34								
	LB2-9					5	112.1	18.1
36								
				SM	Grades into very dense, moist, light grayish brown, Silty, fine to medium SAND, carbonate nodule and veinlets			
38								
40					Grades into very stiff, moist, dark grayish brown, CLAY			
	LB2-10			CL	-Becomes sandy CLAY	5	126.1	10.6
				SC	Grades into dense, moist, brown, Clayey SAND			
42								
44								
				CL	Grades into hard, very dark grayish brown, Silty CLAY to CLAY, shiny parting surface, slightly remolded, carbonate nodules and spots			
	LB2-11					4	100.5	25.6
46								
				SC	Grades into very dense, moist, light brown, Clayey, fine to medium SAND, trace gravel			

Figure A-2,
Log of Boring LB 2, Page 2 of 3

07135-42-03.GPJ

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07135-42-03

BORING LB 2

ELEV. (MSL.) **167'** DATE COMPLETED **12-21-2011**

EQUIPMENT **30" DIAM. BUCKET RIG** BY: **A. SADR**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
48								
50	LB2-12			SM-ML	Interbedded, dense, moist, light brown, Sandy SILT and Silty SAND	5	117.9	16.2
52				SM	Becomes very dense, moist, light brown, Silty SAND			
54								
	LB2-13					10	113.9	19.4
56					BORING TERMINATED AT 56 FEET Boring backfilled with cuttings, no seepage			

Figure A-2,
Log of Boring LB 2, Page 3 of 3

07135-42-03.GPJ

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◥ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

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PROJECT NO. 07135-42-03

BORING LB 3

ELEV. (MSL.) **148'** DATE COMPLETED **12-22-2011**

EQUIPMENT **30" DIAM. BUCKET RIG** BY: **A. SADR**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL	**TOPSOIL/COLLUVIUM** Stiff, moist, very dark grayish brown, Sandy CLAY, caliche veinlets nodule			
2								
4				SM	**TERRACE DEPOSITS** Very dense, moist, medium brown, Silty, fine to medium SAND			
6	LB3-1					4	106.5	8.7
8				CL	Grades into hard, moist, very dark brown, Silty CLAY, shiny parting surface			
10				SM	Depositional contact irregular, near horizontal Very dense, moist, light brown, Silty, fine SAND -A lense of brown, coarse clayey sand at 9.5 feet			
12	LB3-2			SC-CL	Interbeds of very dense, Clayey, fine to medium SAND and hard, moist, Silty CLAY	4	120.5	14.2
14				SW	Very dense, damp, medium brown, Clayey, fine SAND			
16	LB3-3			SP-CL	Interbeds of cohesionless SAND and Silty CLAY	4	104.5	2.9
18				SM	Very dense, moist, yellowish brown, Silty, fine SAND, transitional contact, lenses of dark gray silty clay			
20	LB3-4				-Becomes grayish brown	4	113.5	15.2
22				ML	Hard, moist, light brown, Sandy SILT			
				SM	Grades into very dense, moist, yellowish brown, Silty, fine SAND			

Figure A-3,
Log of Boring LB 3, Page 1 of 2

07135-42-03.GPJ

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07135-42-03

BORING LB 3

ELEV. (MSL.) **148'** DATE COMPLETED **12-22-2011**

EQUIPMENT **30" DIAM. BUCKET RIG** BY: **A. SADR**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
24								
	LB3-5			CL	Grades into hard, moist, very dark brown, Silty CLAY to Sandy CLAY, shiny parting surfaces not sheared	5	127.6	10.0
26				SM	Very dense, moist, brown, Silty, fine to medium SAND			
28				SP	Very dense, moist, medium brown, fine to coarse SAND, near horizontal bedding with gravel lenses			
30	LB3-6					5	122.1	5.5
	LB3-7							
32								
34				SM	Grades into very dense, moist, light brown, Silty, fine to medium SAND			
	LB3-8						99.2	3.5
36								
38								
40					BORING TERMINATED AT 40 FEET Boring backfilled with cuttings			

Figure A-3,
Log of Boring LB 3, Page 2 of 2

07135-42-03.GPJ

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07135-42-03

BORING LB 4

ELEV. (MSL.) **140'** DATE COMPLETED **12-22-2011**

EQUIPMENT **30" DIAM. BUCKET RIG** BY: **A. SADR**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL	**TOPSOIL** Stiff, wet, dark brown, Sand CLAY, root at the upper 1 foot			
2								
4				CL	**TERRACE DEPOSIT** Hard, moist, grayish brown, Silty CLAY with caliche veinlets and nodules			
				SM	Grades into very dense, moist, medium brown, Silty, fine to medium SAND			
6	LB4-1			SM-ML	Grades into grayish brown, Silty, very fine SAND to Sandy SILT	2	113.2	12.9
				SM	Grades into grayish brown and dark brown, Silty, fine SAND, with carbonate nodules up to 1 inch diameter			
8				SP	Grades into very dense, yellowish brown, fine to medium SAND; cohesionless; cross bedded			
10	LB4-2			SM	grades into light grayish brown, Silty, fine SAND	3	112.7	8.5
12				ML	Grades into Sandy SILT with lenses of dark grayish brown, Silty CLAY			
14				SM	Grades into Silty, fine to medium SAND			
16	LB4-3					3	118.6	13.8
					-A lense of yellowish brown sand cohesionless, on the south half of the boring			
18				CL	Grades into very stiff, moist, very dark brown, Silty CLAY, shiny parting surfaces, caliche veinlets			
				SM	Grades into Silty, fine to medium SAND			
20					BORING TERMINATED AT 20 FEET Boring backfilled with cuttings			

Figure A-4,
Log of Boring LB 4, Page 1 of 1

07135-42-03.GPJ

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◪ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07135-42-03

BORING LB 5

ELEV. (MSL.) **137'** DATE COMPLETED **12-22-2011**

EQUIPMENT **30" DIAM. BUCKET RIG** BY: **A. SADR**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL	**TOPSOIL** Firm, wet to moist, very dark brown, Sandy CLAY			
2				SC	**TERRACE DEPOSIT** Dense, moist, grayish brown, Clayey, fine SAND, greenish gray along fractures			
4				SM	Grades into dense, moist, light brown, Silty, fine to medium SAND -A lense of dark brown clay, 3 inch thick, north side of boring			
6				CL-ML	Hard, damp to moist, dark grayish brown, Silty CLAY and Clayey SILTSTONE			
8				CL	Grades into hard dark brown, Sandy CLAY			
10				SM	Very dense, moist, yellowish brown, Silty, fine to medium SAND -Becomes Silty, fine SAND			
12								
14					-A layer of dense, damp, grayish brown, fine to coarse sand from 13½ to 14½ feet			
16					-Layer of fine to coarse sand, 8-12 inch thick at 15 feet			
18					-Interbedded with fine to medium cohesionless sand			
20				ML	Very stiff, moist, dark gray to brown, Sandy SILT			
22				SM	Very dense, moist, brown, Silty, fine to medium SAND			
				SP	Very dense, moist, medium to coarse SAND			
				SM	Dense, moist, light greenish brown, Silty, fine to coarse SAND			

07135-42-03.GPJ

Figure A-5,
Log of Boring LB 5, Page 1 of 2

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◪ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07135-42-03

BORING LB 5

ELEV. (MSL.) **137'** DATE COMPLETED **12-22-2011**

EQUIPMENT **30" DIAM. BUCKET RIG** BY: **A. SADR**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
24								
26				SP	Grades into dense, moist, brown, fine to coarse SAND -Lense of dark brown, clay at 26.5 feet			
28				SM	Becomes very dense, moist, yellowish brown, Silty, fine SAND			
30					BORING TERMINATED AT 30 FEET Boring backfilled with cuttings			

Figure A-5,
Log of Boring LB 5, Page 2 of 2

07135-42-03.GPJ

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◥ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07135-42-03

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 1 ELEV. (MSL.) 96' DATE COMPLETED 12-20-2011 EQUIPMENT JD 450 TRACKHOE BY: A. SADR	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				SM	**ALLUVIUM** Loose, wet, dark brown, Silty, fine to medium SAND			
2								
4			▼					
6					-Becomes light brown -Strong seepage at 5 feet			
8				SM	**TERRACE DEPOSITS** Medium dense, wet to saturated, medium grayish brown, Silty, fine to medium SAND; little clay			
10					TRENCH TERMINATED AT 10 FEET Seepage encountered at 5 feet			

Figure A-6,
Log of Trench T 1, Page 1 of 1

07135-42-03.GPJ

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◥ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07135-42-03

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 2 ELEV. (MSL.) 105' DATE COMPLETED 12-20-2011 EQUIPMENT JD 450 TRACKHOE BY: A. SADR	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				SC	**ALLUVIUM** Loose, saturated, dark brown, Clayey, fine to medium SAND; roots and trash			
2					-Becomes loose, wet, yellowish brown			
4								
				SM	**TERRACE DEPOSITS** Medium dense, wet, yellowish brown, slightly Silty, fine to medium SAND			
6					TRENCH TERMINATED AT 6 FEET Groundwater not encountered			

Figure A-7,
Log of Trench T 2, Page 1 of 1

07135-42-03.GPJ

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. 07135-42-03

TRENCH T 3

ELEV. (MSL.) **80'** DATE COMPLETED **12-20-2011**

EQUIPMENT **JD 450 TRACKHOE** BY: **M. ERTWINE**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0								
				SM	**ALLUVIUM** Loose, moist, dark brown, Silty, fine to medium SAND; some organics			
2								
	T3-1						110.1	3.9
4					-Becomes light brown with fissile rootlets and pinhole porosity			
6	T3-2			SC	Dense, moist, light brown, Clayey, fine to coarse SAND			
8				SC	**TERRACE DEPOSITS** Medium dense, yellowish to olive brown, Clayey, fine to coarse SANDSTONE; some gravel			
	T3-3							
10	T3-4							
					TRENCH TERMINATED AT 11 FEET Groundwater not encountered			

Figure A-8,
Log of Trench T 3, Page 1 of 1

07135-42-03.GPJ

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. 07135-42-03

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 4 ELEV. (MSL.) **120'** DATE COMPLETED **12-20-2011** EQUIPMENT **JD 450 TRACKHOE** BY: **M. ERTWINE**	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				CL	**COLLUVIUM/TOPSOIL** Stiff, moist, dark brown, Sandy CLAY			
2								
4				SM	**TERRACE DEPOSITS** Dense, moist, yellowish brown, Silty, fine to medium SAND; slight cementation			
6	T4-1				TRENCH TERMINATED AT 6 FEET Groundwater not encountered			

Figure A-9,
Log of Trench T 4, Page 1 of 1

07135-42-03.GPJ

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◥ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

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PROJECT NO. 07135-42-03

TRENCH T 5

ELEV. (MSL.) **100'** DATE COMPLETED **12-20-2011**

EQUIPMENT **JD 450 TRACKHOE** BY: **M. ERTWINE**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL	**SURFICIAL LANDSLIDE DEBRIS??** Soft, wet, brown, Sandy CLAY			
2								
4					-Becomes stiff			
6				SC	**TERRACE DEPOSITS** Medium dense, moist, light reddish brown, Clayey SAND; friable blocky texture with some fissile rootlets			
8								
10								
12	T5-1				-Becomes dense, some pinhole porosity, some subrounded gravel, poorly cemented		113.8	13.7
14	T5-2							
16								
18	T5-3			SC	**TERRACE DEPOSITS** Medium dense, wet, reddish brown, Clayey, fine to medium SAND		113.4	14.3
20								
22					TRENCH TERMINATED AT 22 FEET Groundwater not encountered			

Figure A-10,
Log of Trench T 5, Page 1 of 1

07135-42-03.GPJ

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. 07135-42-03

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 6 ELEV. (MSL.) 140' DATE COMPLETED 12-20-2011 EQUIPMENT JD 450 TRACKHOE BY: M. ERTWINE	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				CL	**TOPSOIL** Stiff, moist, dark brown, Sandy CLAY			
2				SC	**TERRACE DEPOSITS** Dense, moist, reddish brown to brown, Clayey, fine to coarse SAND; blocky texture, lightly cemented			
4	T6-1							
6				SM	Dense, moist, yellowish brown, Silty, fine to medium SAND; some pinhole porosity			
8	T6-2							
10								
12					-Pockets of medium dense, clayey sand with pinhole porosity			
14								
16	T6-3							
18					-Lamination of sandy clay			
	T6-4							
20					TRENCH TERMINATED AT 20 FEET Groundwater not encountered			

Figure A-11,
Log of Trench T 6, Page 1 of 1

07135-42-03.GPJ

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◥ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

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GEOCON

PROJECT NO. 07135-42-03

TRENCH T 7

ELEV. (MSL.) **90'** DATE COMPLETED **12-20-2011**

EQUIPMENT **JD 450 TRACKHOE** BY: **M. ERTWINE**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL	**TOPSOIL** Stiff, moist, dark brown, Sandy CLAY			
2								
4				SM	**TERRACE DEPOSITS** Medium dense, moist, light yellowish brown, Silty, fine to medium SAND			
6								
8	T7-1			CL	Hard, moist, gray to olive brown, Sandy CLAY; blocky texture; some pinhole porosity with some fissile rootlets; structures slightly waxy appearance			
10								
12					TRENCH TERMINATED AT 12 FEET Groundwater not encountered			

Figure A-12,
Log of Trench T 7, Page 1 of 1

07135-42-03.GPJ

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

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GEOCON

PROJECT NO. 07135-42-03

TRENCH T 8

ELEV. (MSL.) **128'** DATE COMPLETED **12-20-2011**

EQUIPMENT **JD 450 TRACKHOE** BY: **M. ERTWINE**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	T8-1			CL	**TOPSOIL** Stiff, moist, dark brown, Sandy CLAY			
2								
4	T8-2 T8-3			SM/SC	**TERRACE DEPOSITS** Medium dense, moist, light reddish, Silty to Clayey, fine to medium SAND			
6								
					TRENCH TERMINATED AT 7 FEET Groundwater not encountered			

Figure A-13,
Log of Trench T 8, Page 1 of 1

07135-42-03.GPJ

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◪ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07135-42-03

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 9 ELEV. (MSL.) **100'** DATE COMPLETED **12-20-2011** EQUIPMENT **JD 450 TRACKHOE** BY: **M. ERTWINE**	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				CL	**TOPSOIL** Stiff, moist, dark brown, Sandy CLAY			
2								
4	T9-1			CL-SC	**TERRACE DEPOSITS** Stiff to medium dense, moist, olive brown, Sandy CLAY to Clayey, fine to medium SAND; some subrounded gravel with trace pinhole porosity			
6								
8								
10	T9-2				-Medium dense, moist, light brown, Clayey SAND; weak, some pinholes			
12					TRENCH TERMINATED AT 12 FEET Groundwater not encountered			

Figure A-14,
Log of Trench T 9, Page 1 of 1

07135-42-03.GPJ

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◪ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. 07135-42-03

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 10 ELEV. (MSL.) 85' DATE COMPLETED 12-21-2011 EQUIPMENT JD 450 TRACKHOE BY: N. BORJA MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	T10-1			CL	**COLLUVIUM** Firm, moist, dark brown, Sandy CLAY		108.6	12.7
2								
4	T10-2			ML	**SANTIAGO FORMATION** Firm to stiff, damp, mottled light gray to gay, Sandy SILT; highly weathered; ???? rootlet structure			
6				SM	Dense, damp, light gray, Silty, fine to medium SANDSTONE; weakly cemented			
					TRENCH TERMINATED AT 6.5 FEET Groundwater not encountered			

Figure A-15,
Log of Trench T 10, Page 1 of 1

07135-42-03.GPJ

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◪ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. 07135-42-03

TRENCH T 11

ELEV. (MSL.) **82'** DATE COMPLETED **12-21-2011**

EQUIPMENT **JD 450 TRACKHOE** BY: **N. BORJA**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	T11-1			CH	**ALLUVIUM** Soft to firm, moist, brown to dark brown, Silty CLAY; few roots			
2					-Pockets of shell fragments at 2.5 feet			
4				SC	Medium dense, moist, dark olive brown, Clayey, fine to coarse SAND			
6	T11-2			SM	Medium dense, moist, olive brown, Silty, fine to medium SAND		111.1	10.3
8								
10	T11-3			SM	**TERRACE DEPOSITS** Medium dense to dense, moist, light olive brown to light gray, Silty, fine to medium SANDSTONE			
					TRENCH TERMINATED AT 10.5 FEET Groundwater not encountered			

Figure A-16,
Log of Trench T 11, Page 1 of 1

07135-42-03.GPJ

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◪ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07135-42-03

TRENCH T 12

ELEV. (MSL.) **84'** DATE COMPLETED **12-21-2011**

EQUIPMENT **JD 450 TRACKHOE** BY: **N. BORJA**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**ALLUVIUM** Loose, moist, dark brown, Silty, fine to medium SAND; few roots			
2	T12-1			CL	Firm, damp to moist, brown to dark olive brown, Sandy CLAY; some pockets of light gray sandstone		117.2	11.9
4								
6				SC	**TERRACE DEPOSITS** Medium dense, moist, mottled olive brown and gray and reddish brown, Clayey, fine to medium SAND; pockets of claystone clasts			
8	T12-2			SM	Medium dense, moist, light olive brown and reddish brown, Silty, fine to medium SAND			
	T12-3							
10				SM	Medium dense, moist, yellowish brown and light reddish brown, Silty, fine to medium SANDSTONE			
12								
14								
					TRENCH TERMINATED AT 15 FEET Groundwater not encountered			

Figure A-17,
Log of Trench T 12, Page 1 of 1

07135-42-03.GPJ

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◥ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07135-42-03

TRENCH T 13

ELEV. (MSL.) **95'** DATE COMPLETED **12-21-2011**

EQUIPMENT **JD 450 TRACKHOE** BY: **N. BORJA**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**ALLUVIUM** Loose, moist, dark brown, Silty, fine to medium SAND; few roots			
2				CL	Stiff, damp, dark brown, Sandy CLAY; few rootlets			
4	T13-1			SC	-Excavates with some white stringers Medium dense, damp, brown to dark olive brown, Clayey, fine to medium SAND; few caliche staining			
6								
8	T13-2			CL	**TERRACE DEPOSITS** Stiff, damp to moist, mottled yellowish brown and light olive brown and reddish brown, Sandy CLAY			
10				SC	Medium dense, moist, mottled olive brown and reddish brown, Clayey, fine to medium SAND			
					TRENCH TERMINATED AT 10.5 FEET Groundwater not encountered			

Figure A-18,
Log of Trench T 13, Page 1 of 1

07135-42-03.GPJ

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◪ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07135-42-03

TRENCH T 14

ELEV. (MSL.) **100'** DATE COMPLETED **12-21-2011**

EQUIPMENT **JD 450 TRACKHOE** BY: **N. BORJA**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**ALLUVIUM** Loose, moist, dark brown, Silty, fine to medium SAND; few roots			
2	T14-1			CL	Firm to stiff, damp, dark brown, Sandy CLAY; some rootlets			
4								
6				SM	Medium dense, damp, brown to dark olive brown, Silty, fine to medium SAND			
8	T14-2				-Observed slight pinholes		112.9	8.0
10								
	T14-3			SM	**TERRACE DEPOSITS** Medium dense, damp to moist, yellowish brown to olive brown, Silty, fine to coarse SAND			

TRENCH TERMINATED AT 11 FEET
Groundwater not encountered

Figure A-19,
Log of Trench T 14, Page 1 of 1

07135-42-03.GPJ

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. 07135-42-03

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 15 ELEV. (MSL.) 122' DATE COMPLETED 12-21-2011 EQUIPMENT JD 450 TRACKHOE BY: N. BORJA	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				SC	**COLLUVIUM** Loose, moist, dark brown, Clayey, fine to medium SAND; few roots			
2	T15-1			CL	Firm, moist, dark brown, Sandy CLAY; little rootlets			
4				SC	Medium dense, mist, dark olive brown to brown, Clayey, fine to medium SAND; some caliche staining			
6				SM	**TERRACE DEPOSITS** Medium dense, moist, light olive brown to yellowish brown, Silty, fine to coarse SAND			
8					TRENCH TERMINATED AT 9 FEET Groundwater not encountered			

Figure A-20,
Log of Trench T 15, Page 1 of 1

07135-42-03.GPJ

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◪ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. 07135-42-03

TRENCH T 16

ELEV. (MSL.) **115'** DATE COMPLETED **12-21-2011**

EQUIPMENT **JD 450 TRACKHOE** BY: **N. BORJA**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**ALLUVIUM** Loose, mist, dark brown, Silty, fine to medium SAND; few roots			
2				CL	Stiff, damp, dark brown, Sandy CLAY; some rootlets			
4				SC	Medium dense, moist, brown to dark brown, Clayey, fine to medium SAND; little caliche staining			
6				SM	Medium dense, moist, brown, Silty, fine to coarse SAND			
8				SM	**TERRACE DEPOSITS** Loose to medium dense, mist, mottled light olive brown and yellowish brown, Silty, fine to medium SAND; few clay			
	T16-1			SM	-Becomes medium dense to dense, damp, light gray, Silty, fine to medium SANDSTONE; weakly cemented			
					TRENCH TERMINATED AT 9.5 FEET Groundwater not encountered			

Figure A-21,
Log of Trench T 16, Page 1 of 1

07135-42-03.GPJ

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. 07135-42-03

TRENCH T 17

ELEV. (MSL.) **140'** DATE COMPLETED **12-21-2011**

EQUIPMENT **JD 450 TRACKHOE** BY: **N. BORJA**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**COLLUVIUM** Loose, moist, grayish brown, Silty, fine SAND			
2	T17-1			SC	-Becomes dry, light gray Medium dense, damp, mottled dark brown, Clayey, fine to medium SAND; some rootlets		120.0	9.7
4	T17-2			SM	Medium dense, damp, brown to dark brown, Silty, fine to medium SAND			
6				SM	**TERRACE DEPOSITS**			
8	T17-3				Medium dense to dense, damp, light gray and reddish brown, Silty, fine to medium SANDSTONE			
	T17-4			SC	Medium dense, damp, gray and light reddish brown, Clayey, fine to medium SAND			
					TRENCH TERMINATED AT 9.5 FEET Groundwater not encountered			

Figure A-22,
Log of Trench T 17, Page 1 of 1

07135-42-03.GPJ

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. 07135-42-03

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 18 ELEV. (MSL.) **110'** DATE COMPLETED **12-21-2011** EQUIPMENT **JD 450 TRACKHOE** BY: **N. BORJA**	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				SM	**ALLUVIUM** Loose, moist, dark brown, Silty, fine to medium SAND			
2	T18-1			CH	Soft to firm, dark brown, Silty CLAY			
4				SM	Loose to medium dense, moist, brown, Silty, fine to medium SAND			
6				SC	**TERRACE DEPOSITS** Medium dense, moist, yellowish brown to olive brown and light reddish brown, Clayey, fine to medium SAND			
				SM	Medium dense, moist, yellowish brown to light olive brown, Silty, fine to medium SAND			
8					TRENCH TERMINATED AT 8 FEET Groundwater not encountered			

Figure A-23,
Log of Trench T 18, Page 1 of 1

07135-42-03.GPJ

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◪ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07135-42-03

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	**TRENCH T 19** ELEV. (MSL.) **106'** DATE COMPLETED **12-21-2011** EQUIPMENT **JD 450 TRACKHOE** BY: **N. BORJA**	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				CL	**TOPSOIL** Soft, moist, brown to reddish brown, Sandy CLAY			
2				SM	**TERRACE DEPOSITS** Medium dense, damp, yellowish brown and reddish brown, Silty, fine to coarse SAND			
				SW	Loose, moist, yellowish brown, fine to coarse SAND; little silt			
4				SM	**SANTIAGO FORMATION** Medium dense, damp, light gray to light yellowish brown, Silty, fine to medium SAND			
6					TRENCH TERMINATED AT 6 FEET Groundwater not encountered			

Figure A-24,
Log of Trench T 19, Page 1 of 1

07135-42-03.GPJ

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◪ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07135-42-03

TRENCH T 20

ELEV. (MSL.) **118'** DATE COMPLETED **12-21-2011**

EQUIPMENT **JD 450 TRACKHOE** BY: **N. BORJA**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**ALLUVIUM** Loose, moist, brown to dark brown, Silty, fine SAND			
2				SC	Loose, moist, grayish brown, Clayey, fine SAND			
	T20-1			CL	Stiff, damp, brown, Sandy CLAY; some caliche staining; some rootlets			
4				SM	**TERRACE DEPOSITS** Medium dense, moist, mottled olive and gray and light reddish brown, Silty, fine to medium SAND; trace clay			
	T20-2							
6				CL	Stiff, moist, mottled gray and dark reddish brown, Sandy CLAY -Becomes mottled olive brown and gray and yellowish brown			
	T20-3			SM	Medium dense, damp, mottled olive brown and reddish brown, Silty, fine to medium SANDSTONE; pinhole porosity			
8					TRENCH TERMINATED AT 8 FEET Groundwater not encountered			

Figure A-25,
Log of Trench T 20, Page 1 of 1

07135-42-03.GPJ

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◪ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07135-42-03

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 21 ELEV. (MSL.) **122'** DATE COMPLETED **12-21-2011** EQUIPMENT **JD 450 TRACKHOE** BY: **N. BORJA**	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				SM	**COLLUVIUM** Loose, moist, dark brown, Silty, fine to medium SAND			
2					-Becomes dry; porous			
4				SC	Medium dense, damp, dark brown to grayish brown, Clayey, fine to medium SAND			
6								
8				SM	**TERRACE DEPOSITS** Medium dense, damp, mottled olive brown and reddish brown and gray, Silty, fine to coarse SAND			
					TRENCH TERMINATED AT 8 FEET Groundwater not encountered			

Figure A-26,
Log of Trench T 21, Page 1 of 1

07135-42-03.GPJ

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◥ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

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GEOCON

PROJECT NO. 07135-42-03

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 22 ELEV. (MSL.) **120'** DATE COMPLETED **12-21-2011** EQUIPMENT **JD 450 TRACKHOE** BY: **N. BORJA**	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				CL	**COLLUVIUM** Soft, moist, dark brown, Sandy CLAY			
2				CH	Stiff, moist, dark brown, Silty CLAY			
				SC	Loose to medium dense, moist, olive brown, Clayey, fine to medium SAND; trace caliche staining			
4				SM	Medium dense, damp, brown to olive brown, Silty, fine to medium SAND			
				SM	**TERRACE DEPOSITS** Medium dense, damp, mottled olive brown and gray and light reddish brown, Silty, fine to medium SAND			
6					TRENCH TERMINATED AT 7 FEET Groundwater not encountered			

Figure A-27,
Log of Trench T 22, Page 1 of 1

07135-42-03.GPJ

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◥ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07135-42-03

BORING SB 1

ELEV. (MSL.) **140'** DATE COMPLETED **03-31-2004**

EQUIPMENT **CME 55** BY: **D.GONSMAN**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					**TERRACE DEPOSIT**			
2					Medium dense, moist, dark orange brown, Silty, fine to coarse SAND with clay			
4								
6				SM				
8					-Brown, clayey sand with silt			
10	SB1-1				Very stiff, moist, dark brown, fine to medium Sandy CLAY	33		
12				CL				
14					Medium dense, moist, light orange to brown, Silty, fine SAND; little cohesion			
16								
18								
20	SB1-2					33		
22				SM				
24								
26					-Dense, olive brown, Silty, fine to medium SAND with little clay			
28					-Becomes hard drilling; some blue andesitic; volcanic rock fragments			

Figure A-28,
Log of Boring SB 1, Page 1 of 2

FROM 07135-42-01B.GPJ

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◪ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07135-42-03

BORING SB 1

ELEV. (MSL.) **140'** DATE COMPLETED **03-31-2004**

EQUIPMENT **CME 55** BY: **D.GONSMAN**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30	SB1-3			SM	-Damp, dark olive brown, Clayey, fine SAND; many pinholes	39		
32								
34								
36					-Olive brown, Silty, fine SAND with clay			
38								
40	SB1-4			SM	Dry to damp, light tan-brown, Silty, fine SAND; slightly cemented; easy drilling	48		
42					-Moist, olive brown, Clayey, fine SAND			
44	SB1-5			SP	**SANTIAGO FORMATION** Very dense, damp to moist, pale olive white, Silty, fine to coarse SANDSTONE; well cemented	50/5"		

BORING TERMINATED AT 45.5 FEET
No groundwater encountered
Backfilled 03-31-2004
45.5 to 8 feet-backfilled with bentonite-cement slurry (13.1 cu ft)
8 to 3 feet-backfilled with bentonite chips (1.75 cu ft)
3 to 0 feet-backfilled with soil (1.0 cu ft)

Figure A-28,
Log of Boring SB 1, Page 2 of 2

FROM 07135-42-01B.GPJ

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◥ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07135-42-03

BORING SB 2

ELEV. (MSL.) **145'** DATE COMPLETED **03-31-2004**

EQUIPMENT **CME 55** BY: **D.GONSMAN**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					**TERRACE DEPOSIT**			
2					Medium dense, moist, orange brown, Clayey, fine to coarse SAND			
4								
6	SB2-1							
8								
10	SB2-2			SC	-Dense, damp to moist, Clayey, fine to medium SAND	50		
12								
14								
16								
18								
20								
22					Medium dense, damp, light orange brown, Silty, fine SAND with trace clay			
24								
26	SB2-3			SM	-Little cohesion	29		
28								

FROM 07135-42-01B.GPJ

Figure A-29,
Log of Boring SB 2, Page 1 of 2

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07135-42-03

BORING SB 2

ELEV. (MSL.) **145'** DATE COMPLETED **03-31-2004**

EQUIPMENT **CME 55** BY: **D.GONSMAN**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30								
32					-Fine to coarse			
34								
36	SB2-4			SM	-Dense, damp, light olive brown, Silty, fine to coarse SAND with trace clay, thin interbeds of pale olive sandy clay	61		
38								
40								
42								
44								
46	SB2-5				-Tan brown, Silty, fine to coarse SAND; little cohesion	49		
48								
50	SB2-6			SW	-Light tan, fine to coarse cohesionless sand with some pebbles up to 2 cm diameter	61		
					BORING TERMINATED AT 51 FEET No groundwater encountered Backfilled 03-31-2004 51 to 10 feet-backfilled with bentonite-cement slurry (14.3 cu ft) 10 to 3 feet-backfilled with bentonite chips (2.5 cu ft) 3 to 0 feet-backfilled with soil (1.0 cu ft)			

Figure A-29,
Log of Boring SB 2, Page 2 of 2

FROM 07135-42-01B.GPJ

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◪ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

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PROJECT NO. 07135-42-03

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	**BORING SB 3** ELEV. (MSL.) **146'** DATE COMPLETED **03-31-2004** EQUIPMENT **CME 55** BY: **D.GONSMAN**	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
30	SB3-3			SM	-Light olive tan, Silty, fine to medium SAND; slightly cemented	56		
32								
34								
36								
38								
40	SB3-4				Very dense, moist, light olive gray with some orange, Silty, fine to coarse, well cemented SAND	51/2"		
					BORING TERMINATED AT 41 FEET No groundwater encountered Backfilled 03-31-2004 41 to 5 feet-backfilled with bentonite-cement slurry (12.5 cu ft) 5 to 3 feet-backfilled with bentonite chips (0.75 cu ft) 3 to 0 feet-backfilled with soil (1.0 cu ft)			

Figure A-30,
Log of Boring SB 3, Page 2 of 2

FROM 07135-42-01B.GPJ

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◥ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07135-42-03

BORING SB 3

ELEV. (MSL.) **146'** DATE COMPLETED **03-31-2004**

EQUIPMENT **CME 55** BY: **D.GONSMAN**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					**TERRACE DEPOSIT**			
2					Medium dense, damp, light orange brown, Silty, fine to coarse SAND with trace clay			
4								
6				SM				
8					-Tan brown, Silty, fine to medium SAND			
10	SB3-1				-Very stiff, moist, dark brown, fine Sandy CLAY	40		
12								
14								
16				CL				
18								
20	SB3-2					45		
22					Dense, damp, light brown, Silty, fine to medium SAND; slightly cemented			
24								
26				SM				
28								

Figure A-30,
Log of Boring SB 3, Page 1 of 2

FROM 07135-42-01B.GPJ

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◥ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07135-42-03

BORING SB 4

ELEV. (MSL.) **151'** DATE COMPLETED **04-01-2004**

EQUIPMENT **CME 55** BY: **D.GONSMAN**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					**TERRACE DEPOSIT**			
2				SC	Medium dense, moist, orange brown, Clayey, fine to medium SAND			
4								
6					-Damp, dark brown to brown, fine Sandy CLAY			
8				CL				
10	SB4-1				-Dry to damp, light brown, Silty, fine to medium SAND	33		
12								
14								
16								
18								
20	SB4-2			SM	-Dense, dry, light tan brown, Silty, fine to coarse SAND; slightly cemented	44		
22								
24					-Interbeds of dark brown clay alternating with light brown silty sand			
26								
28								

FROM 07135-42-01B.GPJ

Figure A-31,
Log of Boring SB 4, Page 1 of 3

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◪ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07135-42-03

BORING SB 4

ELEV. (MSL.) **151'** DATE COMPLETED **04-01-2004**

EQUIPMENT **CME 55** BY: **D.GONSMAN**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30	SB4-3				-Damp, light brown, Silty, fine to medium SAND with trace clay	42		
32								
34								
36								
38					-Fine to coarse			
40	SB4-4			SM	-Very dense, light tan brown, Silty, fine to coarse SAND, little cohesion	71		
42								
44								
46								
48								
50	SB4-5				Hard, moist, brown to dark brown, fine Sandy CLAY; slightly remolded zones 2 to 4 cm thick	53		
52								
54				CL				
56								
58								

Figure A-31,
Log of Boring SB 4, Page 2 of 3

FROM 07135-42-01B.GPJ

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◪ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

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PROJECT NO. 07135-42-03

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	**BORING SB 4** ELEV. (MSL.) **151'** DATE COMPLETED **04-01-2004** EQUIPMENT **CME 55** BY: **D.GONSMAN**	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
60	SB4-6			SM	Dense, damp, olive gray, Silty, fine to medium SAND with trace clay	42		
					BORING TERMINATED AT 61 FEET No groundwater encountered Backfilled 04-01-2004 61 to 5 feet-backfilled with bentonite-cement slurry (19.5 cu ft) 5 to 3 feet-backfilled with bentonite chips (0.75 cu ft) 3 to 0 feet-backfilled with soil (1.0 cu ft)			

Figure A-31,
Log of Boring SB 4, Page 3 of 3

FROM 07135-42-01B.GPJ

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◥ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07135-42-03

BORING SB 5

ELEV. (MSL.) **132'** DATE COMPLETED **04-01-2004**

EQUIPMENT **CME 55** BY: **D.GONSMAN**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					**TERRACE DEPOSIT**			
2					Medium dense, damp, light brown, Silty, fine to medium SAND			
4								
6				SM				
8								
10	SB5-1				Very stiff, damp, light orange brown, fine Sandy CLAY; slightly remolded zones 2 to 4 cm thick	37		
12								
14								
16								
18								
20	SB5-2			CL	-Hard, orange brown and tan, fine to coarse Sandy CLAY; some small pinholes	45		
22								
24								
26								
28								

Figure A-32,
Log of Boring SB 5, Page 1 of 2

FROM 07135-42-01B.GPJ

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◥ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07135-42-03

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	**BORING SB 5** ELEV. (MSL.) **132'** DATE COMPLETED **04-01-2004** EQUIPMENT **CME 55** BY: **D.GONSMAN**	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
30	SB5-3			CL	Very stiff, damp to moist, dark brown, fine Sandy CLAY; slightly remolded zones 1 to 2 cm thick	33		
					BORING TERMINATED AT 31 FEET No groundwater encountered Backfilled 04-01-2004 31 to 5 feet-backfilled with bentonite-cement slurry (9.0 cu ft) 5 to 3 feet-backfilled with bentonite chips (0.75 cu ft) 3 to 0 feet-backfilled with soil (1.0 cu ft)			

Figure A-32,
Log of Boring SB 5, Page 2 of 2

FROM 07135-42-01B.GPJ

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◥ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. 07135-42-03

BORING SB 6

ELEV. (MSL.) **126'** DATE COMPLETED **04-01-2004**

EQUIPMENT **CME 55** BY: **D.GONSMAN**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					**TERRACE DEPOSIT**			
2					Medium dense, damp, light brown, Silty, fine to medium SAND with trace clay			
4								
6	SB6-1			SM				
8								
10	SB6-2					36		
12					Very stiff, damp, orange brown, fine Sandy CLAY			
14				CL				
16					Medium dense, orange brown, Silty, fine to coarse SAND with clay			
18								
20	SB6-3				-Dry, light tan to gray, Silty, fine to medium SAND; little cohesion	34		
22				SM				
24								
26								
28								

Figure A-33,
Log of Boring SB 6, Page 1 of 2

FROM 07135-42-01B.GPJ

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◪ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07135-42-03

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	**BORING SB 6** ELEV. (MSL.) **126'** DATE COMPLETED **04-01-2004** EQUIPMENT **CME 55** BY: **D.GONSMAN**	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
30	SB6-4			SM	Dense, damp, light tan gray, Silty, fine to medium SAND; little cohesion	41		
					BORING TERMINATED AT 31 FEET No groundwater encountered Backfilled 04-01-2004 31 to 5 feet-backfilled with bentonite-cement slurry (9.0 cu ft) 5 to 3 feet-backfilled with bentonite chips (0.75 cu ft) 3 to 0 feet-backfilled with soil (1.0 cu ft)			

Figure A-33,
Log of Boring SB 6, Page 2 of 2

FROM 07135-42-01B.GPJ

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◥ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07135-42-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	**TRENCH T 8** ELEV. (MSL.) **160** DATE COMPLETED **07/28/03** EQUIPMENT **JD450 TRACK BACKHOE 24"** BY: **G. COPENHAVER**	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				GM	**COLLUVIUM** Loose, damp, light to medium brown, Silty boulder GRAVEL; with some sand			
2								
4				SM	**SANTIAGO FORMATION** Very dense, damp, light gray - olive, Silty fine SANDSTONE; massive, trace clay			
6								
8								
10								
					TRENCH TERMINATED AT 11 FEET			

Figure A-34,
Log of Trench T 8, Page 1 of 1

07135-42-01.GPJ

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◥ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. 07135-42-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 9 ELEV. (MSL.) 165 DATE COMPLETED 07/28/03 EQUIPMENT JD450 TRACK BACKHOE 24" BY: G. COPENHAVER MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SC	**TOPSOIL** Loose, damp, medium dark, very Gravelly, Clayey SAND			
2				SM	**SANTIAGO FORMATION** Very dense, moist, light grayish - olive, Clayey fine SANDSTONE; some silt, massive			
4								
6					Irregular depositional contact inclined westward approximately 45 degrees			
8					**SALTO INTRUSIVE** Weathered and fractured, medium yellow - olive to brown, moderately strong GRANITIC ROCK; some fractures have discontinuous polished shear surfaces TRENCH TERMINATED AT 8 FEET			

Figure A-35,
Log of Trench T 9, Page 1 of 1

07135-42-01.GPJ

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. 07135-42-01B

TRENCH T - 9C

ELEV. (MSL.) **155'** DATE COMPLETED **05-05-2005**

EQUIPMENT **CAT 330C** BY: **G. COPENHAVER**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0								
				CL	**SANTIAGO FORMATION** Hard, moist, medium olive, Silty CLAYSTONE			
2								
4				SM	Dense to very dense, damp, light brown to tan, very Silty, very fine-grained SANDSTONE; massive to horizontal bedding			
6								
8								
10								
12								
14								
16					-Becomes more dense, but excavates slowly			
18								
20					TRENCH TERMINATED AT 20 FEET			

Figure A-36,
Log of Trench T - 9C, Page 1 of 1

07135-42-01B.GPJ

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◪ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07135-42-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	**TRENCH T 10** ELEV. (MSL.) **136** DATE COMPLETED **07/28/03** EQUIPMENT **JD450 TRACK BACKHOE 24"** BY: **G. COPENHAVER**	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				SM	**UNDOCUMENTED FILL** Loose, humid to damp, light to medium brown, Gravelly, Silty fine SAND; porous, with root fragments, asphalt and concrete chunks, crushed aggregate waste (yellow fill)			
2								
4								
6								
8				SC	Loose to medium dense, damp, medium to dark brown (mottled) Gravelly, Clayey fine SAND			
10								
12					Large 24 inch diameter boulder at 12.5 feet			
					TRENCH TERMINATED AT 13.5 FEET Refusal on oversize rock			

Figure A-37,
Log of Trench T 10, Page 1 of 1

07135-42-01.GPJ

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◪ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. 07135-42-01B

TRENCH T - 10C

ELEV. (MSL.) **148'** DATE COMPLETED **05-05-2005**

EQUIPMENT **CAT 330C** BY: **G. COPENHAVER**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**SANTIAGO FORMATION** Dense, damp, light brown to olive, Silty fine SANDSTONE			
12				SC-GC	Very dense, moist, medium olive-brown, very Gravelly, Clayey SANDSTONE; with oversize rock, core stones (includes some very weathered granitic rock)			
14					**SALTO INTRUSIVE** Weathered, fractured, medium olive-brown, moderately strong GRANITIC ROCK			
					TRENCH TERMINATED AT 14 FEET (Near refusal)			

Figure A-38,
Log of Trench T - 10C, Page 1 of 1

07135-42-01B.GPJ

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◥ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

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PROJECT NO. 07135-42-01B

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T - 11C ELEV. (MSL.) 135' DATE COMPLETED 05-05-2005 EQUIPMENT CAT 330C BY: G. COPENHAVER MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**SANTIAGO FORMATION** Dense, moist, light brown, Silty, fine to medium SANDSTONE			
2					Dense, moist, light brown to olive, Silty to Clayey, fine SANDSTONE			
4				SM				
6								
8				SC	Very dense, moist, medium brown-olive, Gravelly, Clayey, fine SANDSTONE; "floater" boulders of oversize rock (includes corestones of weathered granitic rock)			
10					**SALTO INTRUSIVE** Weathered, fractured, moist to damp, medium olive-brown, moderately strong GRANITIC ROCK			
					TRENCH TERMINATED AT 11 FEET (Near refusal)			

Figure A-39,
Log of Trench T - 11C, Page 1 of 1

07135-42-01B.GPJ

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◪ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

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APPENDIX B

APPENDIX B

LABORATORY TESTING

We performed the laboratory tests in accordance with the current versions of the generally accepted *American Society for Testing Materials* (ASTM) procedures or other suggested procedures. We tested selected soil samples for their in-place density and moisture content, maximum dry density and optimum moisture content, shear strength, expansion index, and water-soluble sulfate characteristics. The results of our laboratory tests are presented on Tables B-I through B-IV and on the boring logs in Appendix A.

TABLE B-I
SUMMARY OF LABORATORY MAXIMUM DRY DENSITY AND OPTIMUM MOISTURE CONTENT TEST RESULTS
ASTM D 1557

Sample No.	Description	Maximum Dry Density (pcf)	Optimum Moisture Content (% dry wt.)
LB1-5	Grayish brown, Silty, fine to medium SAND	118.7	12.7
LB2-4	Reddish brown, Silty, fine to medium SAND	126.5	9.9
LB2-8	Dark brown Silty CLAY	105.0	21.4
T8-3	Dark brown Sandy CLAY	125.5	12.0
T14-1	Grayish brown Silty fine to medium SAND	127.8	9.3

TABLE B-II
SUMMARY OF LABORATORY DIRECT SHEAR TEST RESULTS
ASTM D 3080

Sample No.	Dry Density (pcf)	Moisture Content (%)		Peak [Ultimate] Cohesion (psf)	Peak [Ultimate] Angle of Shear Resistance (degrees)
		Initial	Final		
LB1-5*	106.5	13.1	17.7	500 [70]	33 [37]
LB2-2	108.9	16.4	22.3	110 [0]	35 [36]
LB2-7	98.1	28.4	34.7	670 [490]	20 [20]
T8-3*	113.2	11.8	21.6	650 [600]	19 [19]
T14-1*	114.9	9.4	18.6	275 [255]	30 [30]

*Sample remolded to 90% relative compaction at or near optimum moisture content.
Ultimate measured at 0.2 inch deflection.

TABLE B-III
SUMMARY OF LABORATORY EXPANSION INDEX TEST RESULTS
ASTM D 4829

Sample No.	Moisture Content (%)		Dry Density (pcf)	Expansion Index	Expansion Classification
	Before Test	After Test			
LB1-5	11.3	17.1	104.6	0	Very Low
LB2-4	9.7	21.2	110.2	45	Low
LB2-8	18.3	47.7	86.1	204	Very High
T11-1	10.7	27.6	107.9	120	High
T14-1	9.9	20.9	109.9	36	Low
T18-1	12.3	31.4	101.2	131	Very High

TABLE B-IV
SUMMARY OF LABORATORY WATER-SOLUBLE SULFATE TEST RESULTS
CALIFORNIA TEST NO. 417

Sample No.	Water-Soluble Sulfate (%)	Classification
LB1-5	0.007	Negligible
T11-1	0.026	Negligible
T18-1	0.046	Negligible
T14-1	0.007	Negligible

APPENDIX C

APPENDIX C

SLOPE STABILITY ANALYSES

We performed the slope stability analyses using the two-dimensional computer software *GeoStudio2007* developed by Geo-Slope International Ltd. We analyzed the critical modes of potential slip surfaces including rotational-mode and block-mode based on Spencer's method. The soil parameters used, case conditions, and the calculated factors of safety are presented herein. Plots of analyses' results, including the soil stratigraphy, potential failure surfaces, and calculated factors of safety, are attached within this appendix.

We estimated the shear strength characteristics of the existing geologic units based on laboratory direct shear tests on samples obtained during our field investigation in accordance with ASTM D 3080 (see Appendix B). The soil parameters used for the stability analyses were presented in Table C-I.

TABLE C-I
SUMMARY OF SOIL PROPERTIES USED FOR SLOPE STABILITY ANALYSES

Geologic Unit/Material	Density (pcf)	Cohesion (psf)	Friction Angle (degrees)
Sandy Layer	130	100	35
Clay Layer	125	200	10
Compacted Fill (Qcf)	125	300	30

We used Cross Section B-B′ to perform the slope stability analyses. Table C-II provides a summary of cases analyzed and calculated factors of safety. The case conditions, including the assumed buttresses, are also indicated in the table. A minimum factor of safety of 1.5 under static conditions is currently required by the City of Carlsbad for slope stability. Results of slope stability analyses are plotted on Figures C-1 through C-3.

TABLE C-II
SUMMARY OF SLOPE STABILITY ANALYSES

Cross Section	File Name	Condition of Slope Stability Analyses	Calculated Factor of Safety	Figure Number
B-B′	Case 1a	2:1 Cut Slope, block-mode analysis, static condition	1.16	C-1
B-B′	Case 2a	2:1 Fill slope and buttress (30'), block-mode analysis, static condition	1.55	C-2
B-B′	Case 3a	2:1 Fill slope and buttress (30'), block-mode analysis with single point exit, static condition	1.56	C-3

Project Name: Quarry Creek II
Project No.: 07135-42-03
Case 1a _ Cut Slope - 5deg.gsz

SLOPE/W: Spencer
Slip Surface Option: Block
Sandy Layer 130 pcf 100 psf 35 °
Clay Layer 125 pcf 200 psf 10 °

* Description: Cut slope condition on existing soil.
Bottom clay layer has 5 degrees Out-of-Slope.

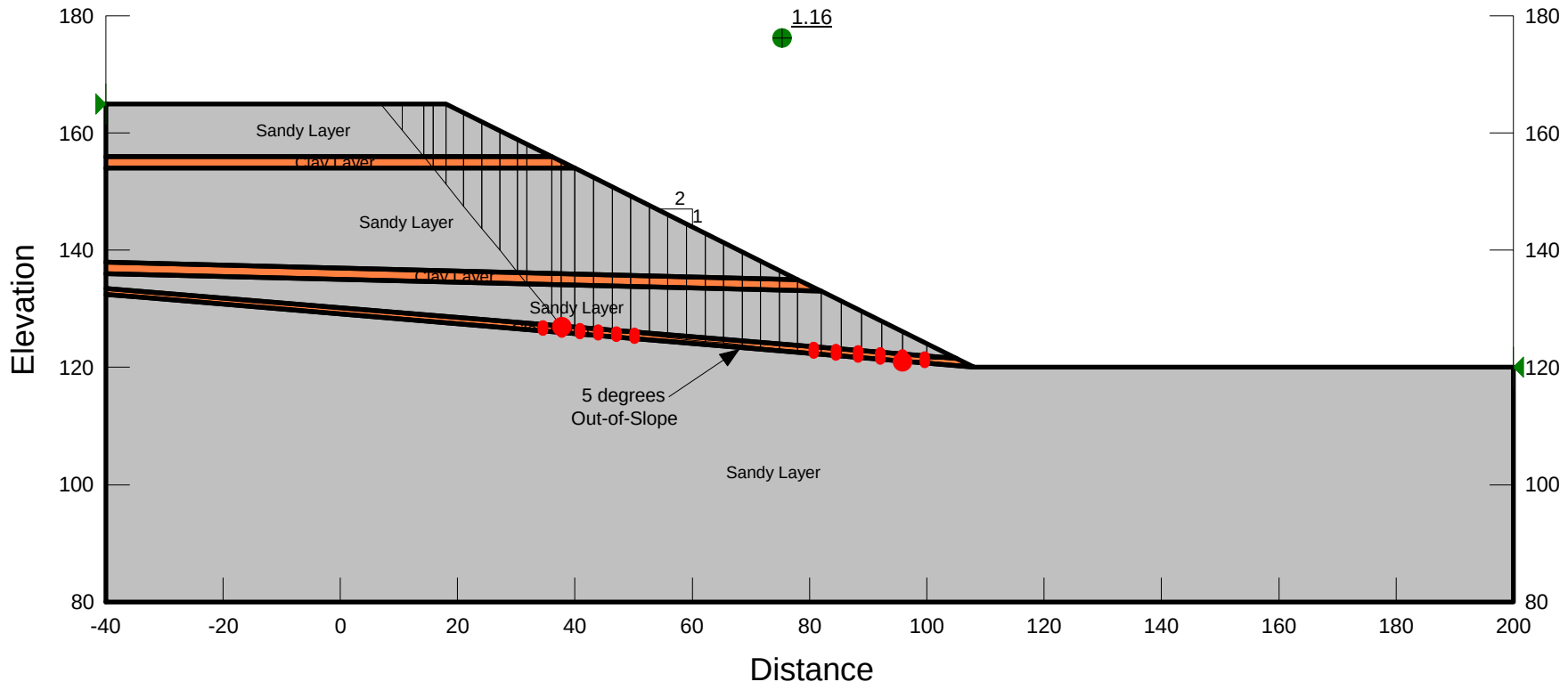

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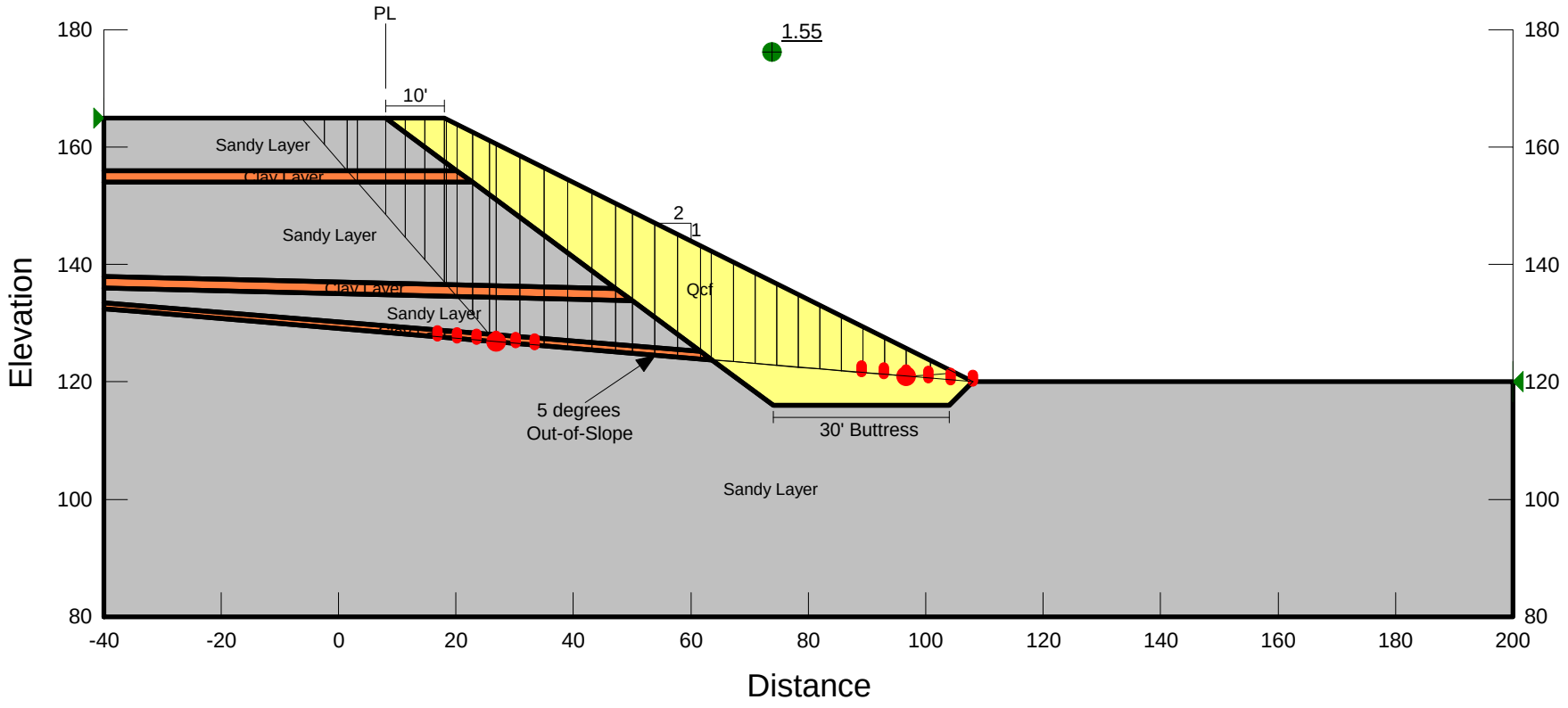
Figure C-1

Project Name: Quarry Creek II
Project No.: 07135-42-03
Case 2a _ Buttress - 5deg.gsz

SLOPE/W: Spencer
Slip Surface Option: Block
Qcf 125 pcf 300 psf 30 °
Sandy Layer 130 pcf 100 psf 35 °
Clay Layer 125 pcf 200 psf 10 °

* Description: Buttress fill slope condition on existing soil.
Bottom clay layer has 5 degrees Out-of-Slope.



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Date: 1/26/2012, 10:33:57 AM

Figure C-2

Project Name: Quarry Creek II
Project No.: 07135-42-03
Case 2a _ Buttress - 5deg(2).gsz

SLOPE/W: Spencer
Slip Surface Option: Block
Qcf 125 pcf 300 psf 30 °
Sandy Layer 130 pcf 100 psf 35 °
Clay Layer 125 pcf 200 psf 10 °

* Description: Buttress fill slope condition on existing soil.
Bottom clay layer has 5 degrees Out-of-Slope.

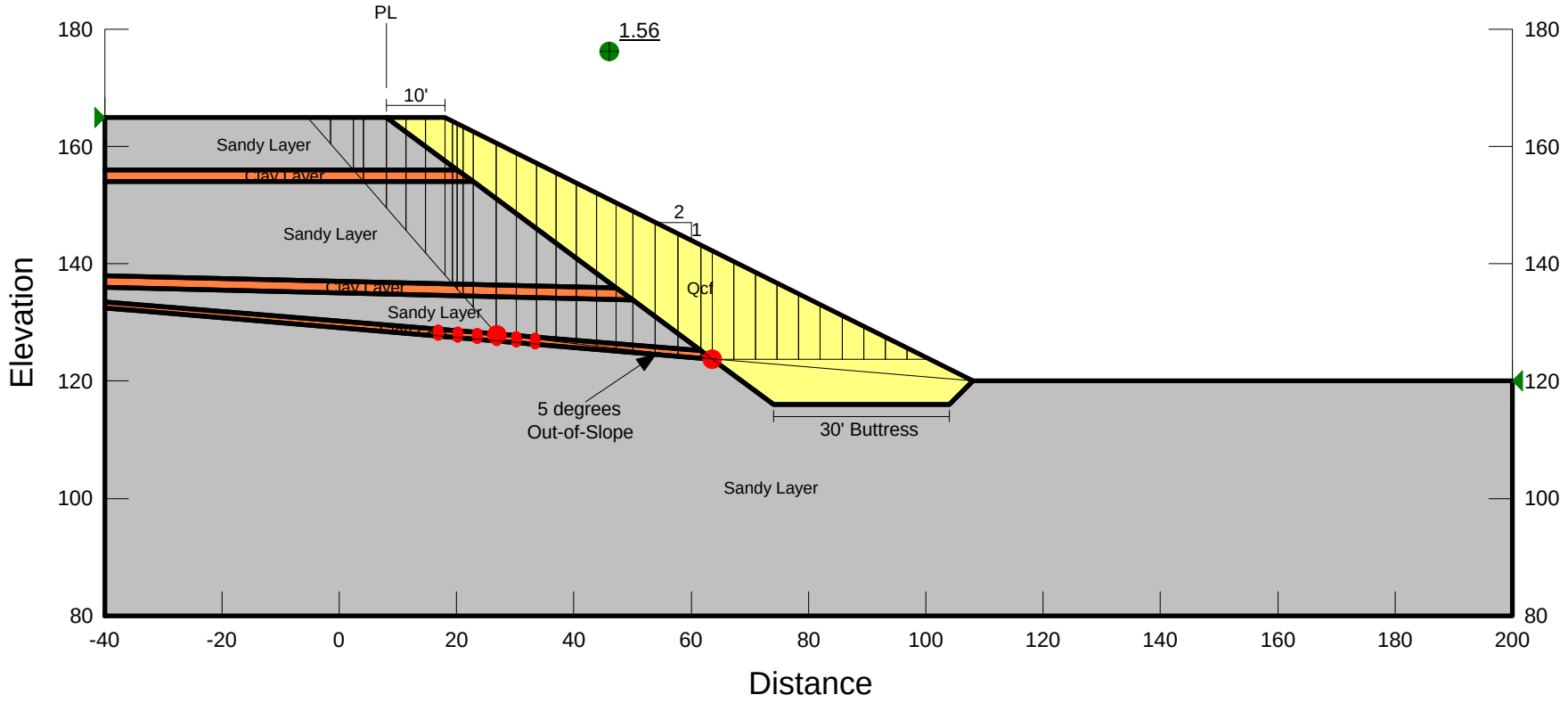

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Figure C-3

APPENDIX D

APPENDIX D

RECOMMENDED GRADING SPECIFICATIONS

FOR

QUARRY CREEK II
CARLSBAD/OCEANSIDE, CALIFORNIA

PROJECT NO. 07135-42-03

RECOMMENDED GRADING SPECIFICATIONS

1. GENERAL

1.1 These Recommended Grading Specifications shall be used in conjunction with the Geotechnical Report for the project prepared by Geocon Incorporated. The recommendations contained in the text of the Geotechnical Report are a part of the earthwork and grading specifications and shall supersede the provisions contained hereinafter in the case of conflict.

1.2 Prior to the commencement of grading, a geotechnical consultant (Consultant) shall be employed for the purpose of observing earthwork procedures and testing the fills for substantial conformance with the recommendations of the Geotechnical Report and these specifications. The Consultant should provide adequate testing and observation services so that they may assess whether, in their opinion, the work was performed in substantial conformance with these specifications. It shall be the responsibility of the Contractor to assist the Consultant and keep them apprised of work schedules and changes so that personnel may be scheduled accordingly.

1.3 It shall be the sole responsibility of the Contractor to provide adequate equipment and methods to accomplish the work in accordance with applicable grading codes or agency ordinances, these specifications and the approved grading plans. If, in the opinion of the Consultant, unsatisfactory conditions such as questionable soil materials, poor moisture condition, inadequate compaction, adverse weather, result in a quality of work not in conformance with these specifications, the Consultant will be empowered to reject the work and recommend to the Owner that grading be stopped until the unacceptable conditions are corrected.

2. DEFINITIONS

2.1 **Owner** shall refer to the owner of the property or the entity on whose behalf the grading work is being performed and who has contracted with the Contractor to have grading performed.

2.2 **Contractor** shall refer to the Contractor performing the site grading work.

2.3 **Civil Engineer** or **Engineer of Work** shall refer to the California licensed Civil Engineer or consulting firm responsible for preparation of the grading plans, surveying and verifying as-graded topography.

2.4 **Consultant** shall refer to the soil engineering and engineering geology consulting firm retained to provide geotechnical services for the project.

2.5 **Soil Engineer** shall refer to a California licensed Civil Engineer retained by the Owner, who is experienced in the practice of geotechnical engineering. The Soil Engineer shall be responsible for having qualified representatives on-site to observe and test the Contractor's work for conformance with these specifications.

2.6 **Engineering Geologist** shall refer to a California licensed Engineering Geologist retained by the Owner to provide geologic observations and recommendations during the site grading.

2.7 **Geotechnical Report** shall refer to a soil report (including all addenda) which may include a geologic reconnaissance or geologic investigation that was prepared specifically for the development of the project for which these Recommended Grading Specifications are intended to apply.

3. MATERIALS

3.1 Materials for compacted fill shall consist of any soil excavated from the cut areas or imported to the site that, in the opinion of the Consultant, is suitable for use in construction of fills. In general, fill materials can be classified as *soil* fills, *soil-rock* fills or *rock* fills, as defined below.

3.1.1 **Soil fills** are defined as fills containing no rocks or hard lumps greater than 12 inches in maximum dimension and containing at least 40 percent by weight of material smaller than ¾ inch in size.

3.1.2 **Soil-rock fills** are defined as fills containing no rocks or hard lumps larger than 4 feet in maximum dimension and containing a sufficient matrix of soil fill to allow for proper compaction of soil fill around the rock fragments or hard lumps as specified in Paragraph 6.2. **Oversize rock** is defined as material greater than 12 inches.

3.1.3 **Rock fills** are defined as fills containing no rocks or hard lumps larger than 3 feet in maximum dimension and containing little or no fines. Fines are defined as material smaller than ¾ inch in maximum dimension. The quantity of fines shall be less than approximately 20 percent of the rock fill quantity.

3.2 Material of a perishable, spongy, or otherwise unsuitable nature as determined by the Consultant shall not be used in fills.

3.3 Materials used for fill, either imported or on-site, shall not contain hazardous materials as defined by the California Code of Regulations, Title 22, Division 4, Chapter 30, Articles 9 and 10; 40CFR; and any other applicable local, state or federal laws. The Consultant shall not be responsible for the identification or analysis of the potential presence of hazardous materials. However, if observations, odors or soil discoloration cause Consultant to suspect the presence of hazardous materials, the Consultant may request from the Owner the termination of grading operations within the affected area. Prior to resuming grading operations, the Owner shall provide a written report to the Consultant indicating that the suspected materials are not hazardous as defined by applicable laws and regulations.

3.4 The outer 15 feet of *soil-rock* fill slopes, measured horizontally, should be composed of properly compacted *soil* fill materials approved by the Consultant. *Rock* fill may extend to the slope face, provided that the slope is not steeper than 2:1 (horizontal:vertical) and a soil layer no thicker than 12 inches is track-walked onto the face for landscaping purposes. This procedure may be utilized provided it is acceptable to the governing agency, Owner and Consultant.

3.5 Samples of soil materials to be used for fill should be tested in the laboratory by the Consultant to determine the maximum density, optimum moisture content, and, where appropriate, shear strength, expansion, and gradation characteristics of the soil.

3.6 During grading, soil or groundwater conditions other than those identified in the Geotechnical Report may be encountered by the Contractor. The Consultant shall be notified immediately to evaluate the significance of the unanticipated condition

4. CLEARING AND PREPARING AREAS TO BE FILLED

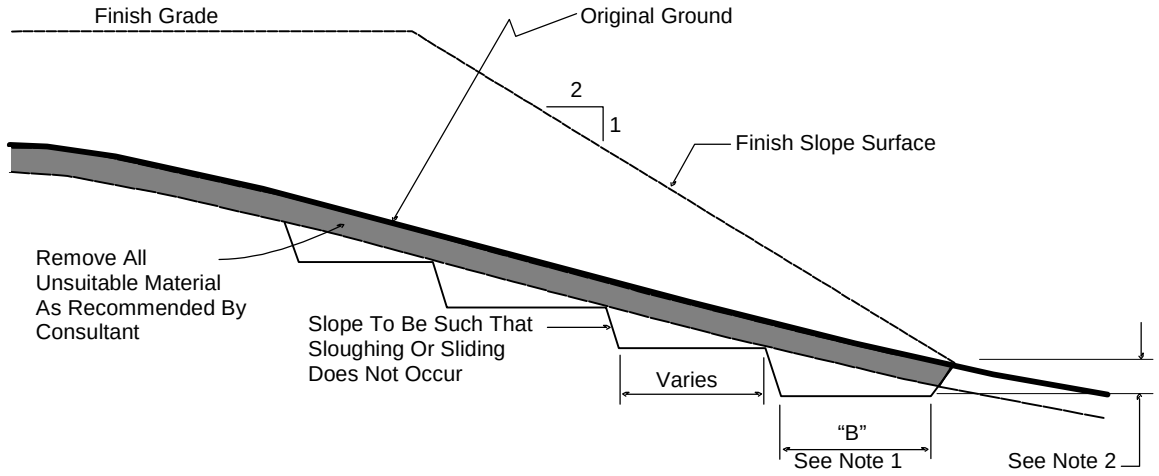
4.1 Areas to be excavated and filled shall be cleared and grubbed. Clearing shall consist of complete removal above the ground surface of trees, stumps, brush, vegetation, man-made structures, and similar debris. Grubbing shall consist of removal of stumps, roots, buried logs and other unsuitable material and shall be performed in areas to be graded. Roots and other projections exceeding 1½ inches in diameter shall be removed to a depth of 3 feet below the surface of the ground. Borrow areas shall be grubbed to the extent necessary to provide suitable fill materials.

4.2 Any asphalt pavement material removed during clearing operations should be properly disposed at an approved off-site facility. Concrete fragments that are free of reinforcing steel may be placed in fills, provided they are placed in accordance with Section 6.2 or 6.3 of this document.

4.3 After clearing and grubbing of organic matter and other unsuitable material, loose or porous soils shall be removed to the depth recommended in the Geotechnical Report. The depth of removal and compaction should be observed and approved by a representative of the Consultant. The exposed surface shall then be plowed or scarified to a minimum depth of 6 inches and until the surface is free from uneven features that would tend to prevent uniform compaction by the equipment to be used.

4.4 Where the slope ratio of the original ground is steeper than 5:1 (horizontal:vertical), or where recommended by the Consultant, the original ground should be benched in accordance with the following illustration.

TYPICAL BENCHING DETAIL



No Scale

DETAIL NOTES: (1) Key width "B" should be a minimum of 10 feet, or sufficiently wide to permit complete coverage with the compaction equipment used. The base of the key should be graded horizontal, or inclined slightly into the natural slope.

(2) The outside of the key should be below the topsoil or unsuitable surficial material and at least 2 feet into dense formational material. Where hard rock is exposed in the bottom of the key, the depth and configuration of the key may be modified as approved by the Consultant.

4.5 After areas to receive fill have been cleared and scarified, the surface should be moisture conditioned to achieve the proper moisture content, and compacted as recommended in Section 6 of these specifications.

5. COMPACTION EQUIPMENT

5.1 Compaction of *soil* or *soil-rock* fill shall be accomplished by sheepsfoot or segmented-steel wheeled rollers, vibratory rollers, multiple-wheel pneumatic-tired rollers, or other types of acceptable compaction equipment. Equipment shall be of such a design that it will be capable of compacting the *soil* or *soil-rock* fill to the specified relative compaction at the specified moisture content.

5.2 Compaction of *rock* fills shall be performed in accordance with Section 6.3.

6. PLACING, SPREADING AND COMPACTION OF FILL MATERIAL

6.1 *Soil* fill, as defined in Paragraph 3.1.1, shall be placed by the Contractor in accordance with the following recommendations:

6.1.1 *Soil* fill shall be placed by the Contractor in layers that, when compacted, should generally not exceed 8 inches. Each layer shall be spread evenly and shall be thoroughly mixed during spreading to obtain uniformity of material and moisture in each layer. The entire fill shall be constructed as a unit in nearly level lifts. Rock materials greater than 12 inches in maximum dimension shall be placed in accordance with Section 6.2 or 6.3 of these specifications.

6.1.2 In general, the *soil* fill shall be compacted at a moisture content at or above the optimum moisture content as determined by ASTM D 1557-02.

6.1.3 When the moisture content of *soil* fill is below that specified by the Consultant, water shall be added by the Contractor until the moisture content is in the range specified.

6.1.4 When the moisture content of the *soil* fill is above the range specified by the Consultant or too wet to achieve proper compaction, the *soil* fill shall be aerated by the Contractor by blading/mixing, or other satisfactory methods until the moisture content is within the range specified.

6.1.5 After each layer has been placed, mixed, and spread evenly, it shall be thoroughly compacted by the Contractor to a relative compaction of at least 90 percent. Relative compaction is defined as the ratio (expressed in percent) of the in-place dry density of the compacted fill to the maximum laboratory dry density as determined in accordance with ASTM D 1557-02. Compaction shall be continuous over the entire area, and compaction equipment shall make sufficient passes so that the specified minimum relative compaction has been achieved throughout the entire fill.

6.1.6 Where practical, soils having an Expansion Index greater than 50 should be placed at least 3 feet below finish pad grade and should be compacted at a moisture content generally 2 to 4 percent greater than the optimum moisture content for the material.

6.1.7 Properly compacted *soil* fill shall extend to the design surface of fill slopes. To achieve proper compaction, it is recommended that fill slopes be over-built by at least 3 feet and then cut to the design grade. This procedure is considered preferable to track-walking of slopes, as described in the following paragraph.

6.1.8 As an alternative to over-building of slopes, slope faces may be back-rolled with a heavy-duty loaded sheepsfoot or vibratory roller at maximum 4-foot fill height intervals. Upon completion, slopes should then be track-walked with a D-8 dozer or similar equipment, such that a dozer track covers all slope surfaces at least twice.

6.2 *Soil-rock* fill, as defined in Paragraph 3.1.2, shall be placed by the Contractor in accordance with the following recommendations:

6.2.1 Rocks larger than 12 inches but less than 4 feet in maximum dimension may be incorporated into the compacted *soil* fill, but shall be limited to the area measured 15 feet minimum horizontally from the slope face and 5 feet below finish grade or 3 feet below the deepest utility, whichever is deeper.

6.2.2 Rocks or rock fragments up to 4 feet in maximum dimension may either be individually placed or placed in windrows. Under certain conditions, rocks or rock fragments up to 10 feet in maximum dimension may be placed using similar methods. The acceptability of placing rock materials greater than 4 feet in maximum dimension shall be evaluated during grading as specific cases arise and shall be approved by the Consultant prior to placement.

6.2.3 For individual placement, sufficient space shall be provided between rocks to allow for passage of compaction equipment.

6.2.4 For windrow placement, the rocks should be placed in trenches excavated in properly compacted *soil* fill. Trenches should be approximately 5 feet wide and 4 feet deep in maximum dimension. The voids around and beneath rocks should be filled with approved granular soil having a Sand Equivalent of 30 or greater and should be compacted by flooding. Windrows may also be placed utilizing an "open-face" method in lieu of the trench procedure, however, this method should first be approved by the Consultant.

6.2.5 Windrows should generally be parallel to each other and may be placed either parallel to or perpendicular to the face of the slope depending on the site geometry. The minimum horizontal spacing for windrows shall be 12 feet center-to-center with a 5-foot stagger or offset from lower courses to next overlying course. The minimum vertical spacing between windrow courses shall be 2 feet from the top of a lower windrow to the bottom of the next higher windrow.

6.2.6 Rock placement, fill placement and flooding of approved granular soil in the windrows should be continuously observed by the Consultant.

6.3 *Rock* fills, as defined in Section 3.1.3, shall be placed by the Contractor in accordance with the following recommendations:

6.3.1 The base of the *rock* fill shall be placed on a sloping surface (minimum slope of 2 percent). The surface shall slope toward suitable subdrainage outlet facilities. The *rock* fills shall be provided with subdrains during construction so that a hydrostatic pressure buildup does not develop. The subdrains shall be permanently connected to controlled drainage facilities to control post-construction infiltration of water.

6.3.2 *Rock* fills shall be placed in lifts not exceeding 3 feet. Placement shall be by rock trucks traversing previously placed lifts and dumping at the edge of the currently placed lift. Spreading of the *rock* fill shall be by dozer to facilitate *seating* of the rock. The *rock* fill shall be watered heavily during placement. Watering shall consist of water trucks traversing in front of the current rock lift face and spraying water continuously during rock placement. Compaction equipment with compactive energy comparable to or greater than that of a 20-ton steel vibratory roller or other compaction equipment providing suitable energy to achieve the

required compaction or deflection as recommended in Paragraph 6.3.3 shall be utilized. The number of passes to be made should be determined as described in Paragraph 6.3.3. Once a *rock* fill lift has been covered with *soil* fill, no additional *rock* fill lifts will be permitted over the *soil* fill.

6.3.3 Plate bearing tests, in accordance with ASTM D 1196-93, may be performed in both the compacted *soil* fill and in the *rock* fill to aid in determining the required minimum number of passes of the compaction equipment. If performed, a minimum of three plate bearing tests should be performed in the properly compacted *soil* fill (minimum relative compaction of 90 percent). Plate bearing tests shall then be performed on areas of *rock* fill having two passes, four passes and six passes of the compaction equipment, respectively. The number of passes required for the *rock* fill shall be determined by comparing the results of the plate bearing tests for the *soil* fill and the *rock* fill and by evaluating the deflection variation with number of passes. The required number of passes of the compaction equipment will be performed as necessary until the plate bearing deflections are equal to or less than that determined for the properly compacted *soil* fill. In no case will the required number of passes be less than two.

6.3.4 A representative of the Consultant should be present during *rock* fill operations to observe that the minimum number of "passes" have been obtained, that water is being properly applied and that specified procedures are being followed. The actual number of plate bearing tests will be determined by the Consultant during grading.

6.3.5 Test pits shall be excavated by the Contractor so that the Consultant can state that, in their opinion, sufficient water is present and that voids between large rocks are properly filled with smaller rock material. In-place density testing will not be required in the *rock* fills.

6.3.6 To reduce the potential for "piping" of fines into the *rock* fill from overlying *soil* fill material, a 2-foot layer of graded filter material shall be placed above the uppermost lift of *rock* fill. The need to place graded filter material below the *rock* should be determined by the Consultant prior to commencing grading. The gradation of the graded filter material will be determined at the time the *rock* fill is being excavated. Materials typical of the *rock* fill should be submitted to the Consultant in a timely manner, to allow design of the graded filter prior to the commencement of *rock* fill placement.

6.3.7 *Rock* fill placement should be continuously observed during placement by the Consultant.

7. OBSERVATION AND TESTING

7.1 The Consultant shall be the Owner's representative to observe and perform tests during clearing, grubbing, filling, and compaction operations. In general, no more than 2 feet in vertical elevation of *soil* or *soil-rock* fill should be placed without at least one field density test being performed within that interval. In addition, a minimum of one field density test should be performed for every 2,000 cubic yards of *soil* or *soil-rock* fill placed and compacted.

7.2 The Consultant should perform a sufficient distribution of field density tests of the compacted *soil* or *soil-rock* fill to provide a basis for expressing an opinion whether the fill material is compacted as specified. Density tests shall be performed in the compacted materials below any disturbed surface. When these tests indicate that the density of any layer of fill or portion thereof is below that specified, the particular layer or areas represented by the test shall be reworked until the specified density has been achieved.

7.3 During placement of *rock* fill, the Consultant should observe that the minimum number of passes have been obtained per the criteria discussed in Section 6.3.3. The Consultant should request the excavation of observation pits and may perform plate bearing tests on the placed *rock* fills. The observation pits will be excavated to provide a basis for expressing an opinion as to whether the *rock* fill is properly seated and sufficient moisture has been applied to the material. When observations indicate that a layer of *rock* fill or any portion thereof is below that specified, the affected layer or area shall be reworked until the *rock* fill has been adequately seated and sufficient moisture applied.

7.4 A settlement monitoring program designed by the Consultant may be conducted in areas of *rock* fill placement. The specific design of the monitoring program shall be as recommended in the Conclusions and Recommendations section of the project Geotechnical Report or in the final report of testing and observation services performed during grading.

7.5 The Consultant should observe the placement of subdrains, to verify that the drainage devices have been placed and constructed in substantial conformance with project specifications.

7.6 Testing procedures shall conform to the following Standards as appropriate:

7.6.1 Soil and Soil-Rock Fills:

7.6.1.1 Field Density Test, ASTM D 1556-02, *Density of Soil In-Place By the Sand-Cone Method.*

7.6.1.2 Field Density Test, Nuclear Method, ASTM D 6938-08A, *Density of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth).*

7.6.1.3 Laboratory Compaction Test, ASTM D 1557-02, *Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-Pound Hammer and 18-Inch Drop*.

7.6.1.4. Expansion Index Test, ASTM D 4829-03, *Expansion Index Test*.

7.6.2 Rock Fills

7.6.2.1 Field Plate Bearing Test, ASTM D 1196-93 (Reapproved 1997) *Standard Method for Nonreparative Static Plate Load Tests of Soils and Flexible Pavement Components, For Use in Evaluation and Design of Airport and Highway Pavements.*

8. PROTECTION OF WORK

8.1 During construction, the Contractor shall properly grade all excavated surfaces to provide positive drainage and prevent ponding of water. Drainage of surface water shall be controlled to avoid damage to adjoining properties or to finished work on the site. The Contractor shall take remedial measures to prevent erosion of freshly graded areas until such time as permanent drainage and erosion control features have been installed. Areas subjected to erosion or sedimentation shall be properly prepared in accordance with the Specifications prior to placing additional fill or structures.

8.2 After completion of grading as observed and tested by the Consultant, no further excavation or filling shall be conducted except in conjunction with the services of the Consultant.

9. CERTIFICATIONS AND FINAL REPORTS

9.1 Upon completion of the work, Contractor shall furnish Owner a certification by the Civil Engineer stating that the lots and/or building pads are graded to within 0.1 foot vertically of elevations shown on the grading plan and that all tops and toes of slopes are within 0.5 foot horizontally of the positions shown on the grading plans. After installation of a section of subdrain, the project Civil Engineer should survey its location and prepare an *as-built* plan of the subdrain location. The project Civil Engineer should verify the proper outlet for the subdrains and the Contractor should ensure that the drain system is free of obstructions.

9.2 The Owner is responsible for furnishing a final as-graded soil and geologic report satisfactory to the appropriate governing or accepting agencies. The as-graded report should be prepared and signed by a California licensed Civil Engineer experienced in geotechnical engineering and by a California Certified Engineering Geologist, indicating that the geotechnical aspects of the grading were performed in substantial conformance with the Specifications or approved changes to the Specifications.

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